Railway Maintenance Engineer

Volume 17 CHICAGO—AUGUST, 1921—NEW YORK Number 8

COMBINED with their feature of strength—which, under actual test, has been proven many times stronger than cast metal—Q & C Rolled Steel Step Joints embody the factors of safety and economy. By our process of manufacture a rolled steel joint with the Bonzano and Thomson features (the strength giving depending flange and metal distribution at the head) is pressed to fit any rail section. This process involves heat treatment which further strengthens the joint and also permits pressing to a perfect fit. On your road you want the step joints that are most efficient. A card will bring you any information. Write us today.

THE Q & C CO.

RAILWAY EXCHANGE BLDG. ST. LOUIS

90 West St., New York

PEOPLES GAS BLDG., CHICAGO.

A Plan for Reducing Crossing Maintenance

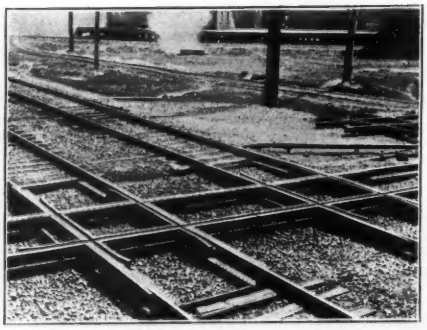
As practised by Mr. H. M. Steward, Supt. of Maintenance, The Boston Elevated Railway Company. As reported in the March issue of "Electric Traction."

"ON all railroad main-line tracks solid manganese steel crossings, seven inches in depth, are used and are laid on INTERNATIONAL STEEL CROSSING FOUNDATIONS, which are laid on from 10 to 12 inches of broken stone tamped with pneumatic tool. A six-inch concrete paving base is installed and the crossings are paved with granite block and grout joints. Anti-rail creepers are installed for a considerable distance on the steam railroad tracks on either side of the crossings to prevent them getting out of line."

"It is found that if the above type of construction is installed properly the maintenance problem becomes of no moment. Only minor repairs are required during the life of the crossing frogs."

To assist you in a careful consideration of this method of economizing on crossing maintenance we prepare complete proposal plans showing INTERNATIONAL STEEL CROSSING FOUNDATIONS under your crossings.

WRITE TODAY!



Steel Crossing Foundations in C.C.C. & St. L. R.R. Main Line since Dec. 1914.

The International Steel Tie Company

16702 Waterloo Road, Cleveland, Ohio

International Products: **Steel Twin Ties; Steel Crossing Foundations; and Steel Paving Guard;** are manufactured and sold in Canada by the Sarnia Bridge Company, Ltd., Sarnia, Ont.

International Steel Crossing Foundations

RAILWAY MAINTENANCE ENGINEER
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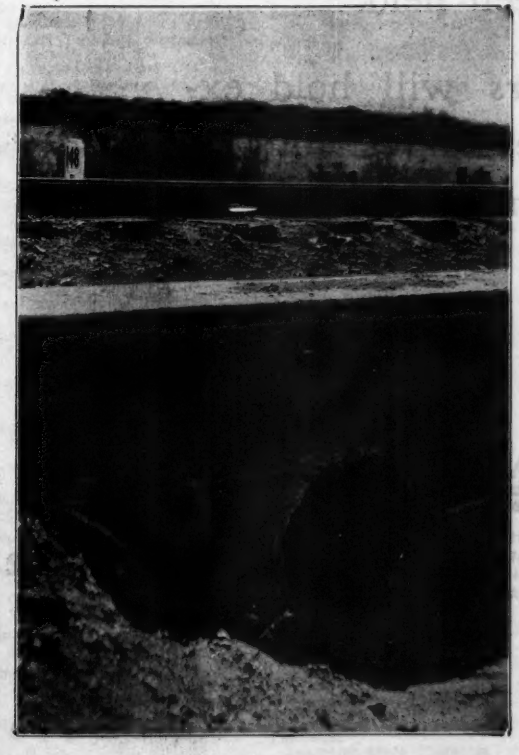
Alphabetical Index to Advertisements Page 5 Classified Index of Advertisers Pages 5 and 6

The Culverts for the Permanent Road

The rust-resisting qualities of ARMCO INGOT IRON enable Armco Culverts to withstand the severest strains, and exposure to all kinds of weather through years of service. Alternate freezing and thawing and the accumulation of debris has no effect on them. Rigid requirements in gauging and coating increase their durability and strength.

ARMCO CULVERTS



The culverts here shown, installed 12 years ago on the main line of one of the country's great railroads, are only two of hundreds which after a decade or more of service show not the slightest evidence of deterioration.

There is a manufacturer in nearly every state and in Canada, making genuine rust-resisting ARMCO CULVERTS and other products of ARMCO INGOT IRON, such as flumes, siphons, tanks, road signs, roofing, etc. Write for full information and nearest shipping point on products in which you are interested.

Armco Culvert & Flume Mfrs. Assn.

215 No. Michigan Ave.
Chicago

WHEN LAYING RAIL

The American Railway Engineering Association specifies expansion allowances varying from 5/16 in. to 1/16 in. according to temperature.

The rail-laying gang applies the thermometer and selects its shims carefully according to its indications.

The first train over bunches the rails because the expansion allowances have not been held.

Rail Anti-Creepers will hold expansion allowances and should be applied ***when*** the rails are laid.

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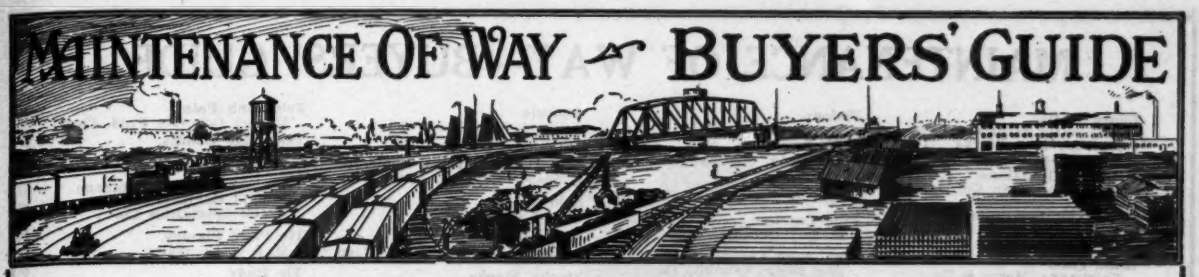

ALPHABETICAL INDEX TO ADVERTISEMENTS

A

Air Reduction Co., Inc. 13
American Casting Co. 25
American Chain Co., Inc. 11
American Hoist & Derrick Co. 33
American Saw Mill Machinery Co. 25
American Valve and Meter Co. 8
American Well Works 9
Armco Culvert & Flume Mfrs. Assn. 3

B

Bethlehem Steel Company 24

C

Chicago Steel Post Co. 18
Classified Advertisements 24

D

De Vilbiss Mfg. Co., The 25
Diamond State Fibre Co. 27
Dixon Crucible Co., Joseph 27
Du Pont, E. I., De Nemours & Co., Inc. 15

F

Fairbanks, Morse & Co. 23
Fairmont Gas Engine and Ry. Motor Car Co. 16

G

Golden-Anderson Valve Specialty Co. 29

H

Headley Good Roads Co. 27

I

Ingersoll-Rand Co. 14
International Steel Tie Co. 2

L

Lundie Engineering Corp. 30

M

Massey Concrete Products Corp. ... 28
Minwax Co., Inc. 21

N

National Lock Washer Co., The .. 31
North American Engine Co. 30

Q

Q and C Co., The 1

P

P. and M. Co., The 4
Pelton Steel Co. 17
Pittsburgh-Des Moines Steel Co. .. 28
Positive Lock Washer Co. 12

R

Rail Joint Co. 26
Ramapo Iron Works 7
Rawls Mach. & Mfg. Co. 29
Republic Creosoting Co. 19
Ruberoid Co., The 29

S

St. Louis Frog and Switch Co. 26
Stowell Co. 30
Sullivan Machinery Co. 30

V

Verona Tool Works 32

W

Weir Frog Co. 26
Wharton & Co., Wm., Jr. 26
Wood Shovel and Tool Co., The ... 10

CLASSIFIED INDEX OF ADVERTISERS

Acetylene, Dissolved.
Air Reduction Co., Inc.

Adjustable Rail Clamps.
Wm. Wharton, Jr., & Co.

Air Compressors.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Air Hoists.
Ingersoll-Rand Co.

Air-Lift Pumping Systems.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Alloy Steel Castings.
Pelton Steel Co.

Anchors.
P. & M. Co., The.

Anti-Creepers.
P. & M. Co., The.

Apparatus, Brazing, Welding and Cutting, Heat Treatment.
Air Reduction Co., Inc.

Argon.
Air Reduction Co., Inc.

Asphalt.
Ruberoid Co., The.

Asphalt Shingles.
Ruberoid Co., The.

Automatic Pump Starters.
Golden-Anderson Valve Specialty Co.

Automatic Valves.
Golden-Anderson Valve Specialty Co.

Barges and Hulls.
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.

Barrels.
Diamond State Fibre Co.

Bars.
Bethlehem Steel Company.

Benders, Rail.
American Chain Co., Inc.
Q. & C. Company.
Verona Tool Works.

Billets.
Bethlehem Steel Company.

Blasting Powders.
E. I. du Pont de Nemours & Co.

Blasting Supplies.
E. I. du Pont de Nemours & Co.

Blow Pipes, Oxy-Acetylene.
Air Reduction Co., Inc.

Bolts.
Bethlehem Steel Company.

Bond Wire.
Armco Culvert & Flume Mfrs. Assn.

Boronic Zinc Alloy.
American Boron Products Co.

Brazing.
Air Reduction Co., Inc.

Buildings.
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.

Building Papers.
Ruberoid Co., The.

Burners, Bunsen, Acetylene.
Air Reduction Co., Inc.

Calcium Carbide.
Air Reduction Co., Inc.

Car Jacks
Duff Manufacturing Co.

Cars, Motor, Inspection.
Fairbanks, Morse & Co.
Fairmont Gas Engine & Ry. Motor Car Co.
North American Engine Co.

Cars, Motor, Section.
Fairbanks, Morse & Co.
Fairmont Gas Engine & Ry. Motor Car Co.

Cars, Velocipede.
Fairbanks, Morse & Co.
Fairmont Gas Engine & Ry. Motor Car Co.
North American Engine Co.

Castings.
Bethlehem Steel Company.

Cattle Guards.
Fairbanks, Morse & Co.

Cattle Passes.
Massey Concrete Prod. Corp.

Clutch Linings.
Diamond State Fibre Co.

Coaling Stations.
Des Moines Bridge & Iron Co.
Fairbanks, Morse & Co.
Pittsburgh-Des Moines Steel Co.

Compromise Joints.
Bethlehem Steel Company.

Compromise Rail Joints.
Track Specialties Co.

Conduits.
Diamond State Fibre Co.

Copper Cleansers.
American Boron Products Co.

Corrugated Iron.
Armco Culvert & Flume Mfrs. Assn.

Creosote Oil.
Republic Creosoting Co.

Crossings, Highway Bituminous.
Headley Good Roads Co.

Crossings.
Bethlehem Steel Company.
St. Louis Frog & Switch Co.
Weir Frog Co.
Wm. Wharton, Jr., & Co.

Crossing Foundations.
International Steel Tie Co.

Culverts.
Armco Culvert & Flume Mfrs. Assn.

Culvert Pipe, Cast Iron.
American Casting Co.

Culvert Pipe, Concrete.
Massey Concrete Prod. Corp.

Curbing.
Massey Concrete Prod. Corp.

Cutting, Oxy-Acetylene.
Air Reduction Co., Inc.

Derails.
American Chain Co., Inc.
Q. & C. Company.
Track Specialties Co.
Wm. Wharton, Jr., & Co.

Ditchers.
American Hoist & Derrick Co.

Dynamite.
E. I. du Pont de Nemours & Co.

Dredges.
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.

Drop Forgings.
Bethlehem Steel Company.

Engines.
Fairbanks, Morse & Co.

Electric Light & Power Plants.
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Electric Steel Castings.
Stowell Co.

Electric Valves.
Golden-Anderson Valve Specialty Co.

Engines.
Fairmont Gas Engine & Ry. Motor Car Co.

Engines, Hand Car.
Fairbanks, Morse & Co.
Fairmont Gas Engine & Ry. Motor Car Co.
North American Engine Co.

Explosives.
E. I. du Pont de Nemours & Co.

Fans.
Fairbanks, Morse & Co.
Fairmont Gas Engine & Ry. Motor Car Co.

Fence Posts.
Chicago Steel Post Co.
Massey Concrete Prod. Corp.

Fibre, Insulating.
Q. & C. Company.

Flangers, Snow.
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Float Valves.
American Valve & Meter Co.
Golden-Anderson Valve Specialty Co.

Forgings.
Bethlehem Steel Company.
Duff Manufacturing Co.

Forge Hammers.
Sullivan Machinery Co.

Frogs.
American Manganese Steel Co.
Bethlehem Steel Company.
Ramapo Iron Works.
St. Louis Frog & Switch Co.
Track Specialties Co.
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Gages, Pressure, Gas.
Air Reduction Co., Inc.

Gas, Acetylene.
Air Reduction Co., Inc.

Gears.
Diamond State Fibre Co.

Generators, Acetylene.
Air Reduction Co., Inc.

Girder Rail.
Bethlehem Steel Company.

Graphite.
Jos. Dixon Crucible Co.

Grinders (Portable).
Ingersoll-Rand Co.

MAINTENANCE OF WAY—BUYERS' GUIDE

Guard Rails.
Bethlehem Steel Company.
Ramapo Iron Works.
Wm. Wharton, Jr., & Co.

Guard Rail Clamps.
American Chain Co., Inc.
Q. & C. Company.
Ramapo Iron Works.
Track Specialties Co.
Weir Frog Co.

Hand Cars.
Fairbanks, Morse & Co.

Hand Car Engines.
Fairmont Gas Engine & Ry. Motor Car Co.
North American Engine Co.

Hammer Drills.
Sullivan Machinery Co.

High Tee Rail.
Bethlehem Steel Company.

Hoists.
Fairbanks, Morse & Co.

Insulated Rail Joints.
Rail Joint Co.
Track Specialties Co.

Junction Boxes.
Massey Concrete Prod. Corp.

Jacks.
Duff Manufacturing Co.
Fairbanks, Morse & Co.
Verona Tool Works.

Locomotive Jacks.
Duff Manufacturing Co.

Lubricants.
Jos. Dixon Crucible Co.

Machinery.
Bethlehem Steel Company.

Machinery, Gas Producers.
Air Reduction Co., Inc.

Malleable Castings.
Stowell Co.

Manganese Steel Castings.
Pelton Steel Co.

Manganese Track Work.
Bethlehem Steel Company.
Ramapo Iron Works.
Wm. Wharton, Jr., & Co.

Manholes.
Massey Concrete Prod. Corp.

Markers.
Massey Concrete Prod. Corp.

Membranous Waterproofing.
Minwax Co., Inc.

Metal Cleansers.
American Boron Products Co.

Mile Posts.
Massey Concrete Prod. Corp.

Motor Cars.
Fairbanks, Morse & Co.
Fairmont Gas Engine & Ry. Motor Car Co.

Mowers, Track.
Rawls Machine & Mfg. Co.

Nitrogen.
Air Reduction Co., Inc.

Nut Locks.
National Lock Washer Co.
Positive Lock Washer Co.

Nuts.
Bethlehem Steel Company.

Oil Engines.
Bethlehem Steel Company.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.

Oil Houses.
Massey Concrete Prod. Corp.

Ordnance.
Bethlehem Steel Company.

Out Houses.
Massey Concrete Prod. Corp.

Outfit, Welding.
Air Reduction Co., Inc.

Oxygen.
Air Reduction Co., Inc.

Paints.
Jos. Dixon Crucible Co.
Ruberoid Co., The.

Paint Spraying Equipment.
De Vilbiss Mfg. Co., The.

Pencils.
Jos. Dixon Crucible Co.

Penstocks.
American Valve & Meter Co.

Pig Iron.
Bethlehem Steel Company.

Piling.
Massey Concrete Prod. Corp.

Pinions.
Diamond State Fibre Co.

Pipe, Cast Iron.
American Casting Co.

Pipe, Concrete.
Massey Concrete Prod. Corp.

Pipe Carriers.
Massey Concrete Prod. Corp.

Pipe Joint Compound.
Jos. Dixon Crucible Co.
Ruberoid Co., The.

Pipe, Riveted Steel.
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.

Plants, Welding and Cutting.
Air Reduction Co., Inc.

Pneumatic Tie Tampers.
Ingersoll-Rand Co.

Poles, Concrete.
Massey Concrete Prod. Corp.

Powders.
E. I. du Pont de Nemours & Co.

Power Houses.
Massey Concrete Prod. Corp.

Producers, Gas.
Air Reduction Co., Inc.

Pumps.
American Well Works.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Push Cars.
Fairbanks, Morse & Co.

Rail Anchors.
P. & M. Co., The.

Rail Anti-Creepers.
P. & M. Co., The.

Rail Benders.
Fairbanks, Morse & Co.
Q. & C. Company.
Track Specialties Co.

Rail Braces.
Bethlehem Steel Company.
Q. & C. Company.
Ramapo Iron Works.
Track Specialties Co.
Weir Frog Co.
Wm. Wharton, Jr., & Co.

Rail Joints.
American Chain Co., Inc.
Q. & C. Company.
Rail Joint Co.
Wm. Wharton, Jr., & Co.

Rail Saws.
Fairbanks, Morse & Co.
Industrial Works.
Q. & C. Company.

Rare Gases.
Air Reduction Co., Inc.

Regulators, Oxy-Acetylene.
Air Reduction Co., Inc.

Replacers, Car
American Chain Co., Inc.
Q. & C. Company.

Riveting Hammers.
Ingersoll-Rand Co.
Verona Tool Works.

Rivets.
Bethlehem Steel Company.

Rock Drills.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works.

Rods, Welding.
Air Reduction Co., Inc.

Roof Slabs.
Fairbanks, Morse & Co.
Massey Concrete Prod. Corp.

Roofing and Siding.
Fairbanks, Morse & Co.

Saw Mills.
American Saw Mill Machinery Co.

Screw Spike Drivers.
Ingersoll-Rand Co.

Sewer Pipe.
American Casting Co.
Massey Concrete Prod. Corp.

Sewer Pipe Seal Compound.
Ruberoid Co., The.

Sheets, Fibre.
Diamond State Fibre Co.

Sheet Iron.
Armco Culvert & Flume Mfrs. Assn.

Shovels.
Wood Shovel and Tool Co., The.

Signal Foundations, Concrete.
Massey Concrete Prod. Corp.

Skid Shoes.
Q. & C. Company.

Slabs, Concrete.
Massey Concrete Prod. Corp.

Smoke Stacks.
Des Moines Bridge & Iron Co.
Massey Concrete Prod. Corp.
Pittsburgh-Des Moines Steel Co.

Snow Melting Devices.
Q. & C. Company.

Snow Plows.
Q. & C. Company.

Special Analysis Steel Castings.
Pelton Steel Co.

Spikes.
Bethlehem Steel Company.

Spraying Equipment, Paint.
De Vilbiss Mfg. Co., The.

Standard Tee Rails.
Bethlehem Steel Company.

Standpipes.
American Valve & Meter Co.
Des Moines Bridge & Iron Co.
Fairbanks, Morse & Co.
Pittsburgh-Des Moines Steel Co.

Station Houses.
Massey Concrete Prod. Corp.

Steam Shovels.
American Hoist & Derrick Co.

Steel Castings.
Pelton Steel Co.

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Bethlehem Steel Company.
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.

Steel Posts.
Chicago Steel Post Co.

Steel Shovels.
Wood Shovel and Tool Co., The.

Steel Ties.
International Steel Tie Co.

Step Joints.
American Chain Co., Inc.
Q. & C. Company.
Rail Joint Co.

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Bethlehem Steel Company.
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Ingersoll-Rand Co.

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Des Moines Bridge & Iron Co.
Fairbanks, Morse & Co.
Pittsburgh-Des Moines Steel Co.

Tank Valves.
American Valve & Meter Co.

Telegraph Poles.
Massey Concrete Prod. Corp.

Telephone Booths.
Massey Concrete Prod. Corp.

Tie Plates.
Bethlehem Steel Company.
Lundie Engineering Corp.
Track Specialties Co.

Tie Plate Clamps.
Q. & C. Company.

Tie Rods
Bethlehem Steel Company.

Tie Spacers.
American Chain Co., Inc.

Tin Plate.
Bethlehem Steel Company.

Tongue Switches.
Bethlehem Steel Company.

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Air Reduction Co., Inc.

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Torches, Welding Acetylene.
Air Reduction Co., Inc.

Torches, Welding and Cutting.
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Diamond State Fibre Co.

Track Jacks.
Duff Manufacturing Co.
Verona Tool Works.

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Ramapo Iron Works.
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Rawls Machine & Mfg. Co.

Track Pans.
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.

Track Scales.
Fairbanks, Morse & Co.

Track Tools.
Fairbanks, Morse & Co.
Q. & C. Company.
Verona Tool Works.

Trestle Slabs.
Massey Concrete Prod. Corp.

Valves.
Golden-Anderson Valve Specialty Co.

Varnish, Electrical Insulating.
Ruberoid Co., The.

Washers.
Diamond State Fibre Co.

Water Column.
American Valve & Meter Co.

Water Crane.
American Valve & Meter Co.

Waterproofing.
Minwax Co., Inc.
Ruberoid Co., The.

Water Regulating Valves.
Golden-Anderson Valve Specialty Co.

Water Tanks.
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.

Welding, Oxy-Acetylene.
Air Reduction Co., Inc.

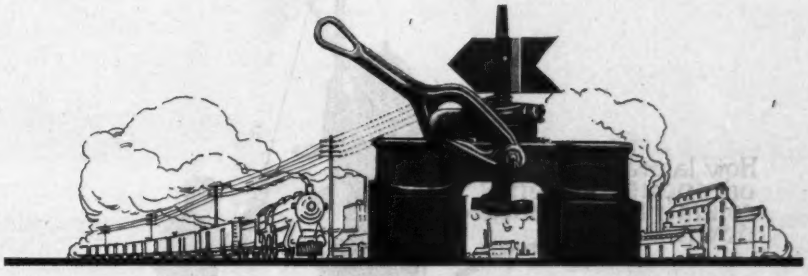
Wheels (Hand and Motor Car).
Fairmont Gas Engine & Ry. Motor Car Co.

Wire.
Armco Culvert & Flume Mfrs. Assn.

Wire Rope.
Fairbanks, Morse & Co.

Wood Preserving Oil.
Republic Creosoting Co.

Wood Working Machinery.
American Saw Mill Machinery Co.

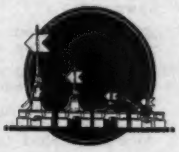


Repairs for breakage that could be avoided mean an unproductive investment—Delays a loss to road and patrons

The yard foreman has plenty of responsibility without the added care of looking after rigid switch stands and necessary repairs on switch stands and switch points.

If the installation of automatic stands in a yard will save the work of two or three men an investment for such equipment would be justified. Consider also the longer life of the automatic stand, the longer life of the switch points, rods, ties, rail braces, etc.; all are unharmed when a switch is run through accidentally.

Ramapo Automatic Safety Switch Stands have come to be recognized as standard permanent equipment wherever installed, and they are absolutely safe. The operation by hand lever is simple and positive. When a switch is run through accidentally the stand operates automatically whether it is locked or not. In either event the target always indicates the position of the switch points. These are exclusively Ramapo features.



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30 Church Street
New York

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Hillburn, N.Y.
Niagara Falls, N.Y.

How many of your water columns are knocked down every year?

What do the repairs and maintenance—not the result of ordinary use—cost you?

Avoid this annoyance, trouble and expense by using a

POAGE Style "H" *WATER COLUMN with* FENNER DROP SPOUT

The three foot lateral range in the Fenner spout and the steel riser in the Poage Style H save the water column from being knocked down by the shifting of the tender.

The tender has to leave the track to knock this column down.

The flexible spout makes it unnecessary to spot the tender accurately. You save time by quick adjustment.

The five foot up and down range enables the water column to fill a tender of any height.

The open telescopic joint does not waste a drop of water. It banishes the usual winter time troubles. Ice does not collect upon it.

The valve permits the maximum amount of water to flow in the shortest time. There is a minimum of frictional resistance. It shuts the water off quick without water hammer.

Try the Poage Style H column. You will find that it has remarkable operating advantages.

MANUFACTURED EXCLUSIVELY BY

THE AMERICAN VALVE & METER CO.

CINCINNATI, OHIO

When a Railroad Buys American Pumps

And then buys more American Pumps —and again buys more American Pumps —because American engineers and American Pumps solved the pumping installation problems to such good effect that lower cost per gallon and less maintenance was the result—would it not be worth *your* while to get figures in black and white as to just what was accomplished?

The suggestions of engineers—specialists in railroad pumping practice—should prove interesting.

THE AMERICAN WELL WORKS

General Office and Works
AURORA, ILL.

Chicago Office
First National Bank Bldg.

These shovels save time, energy, and money

USE Wood's Mo-*lyb*-den-um Shovels for a few months, and you will realize that they save time, energy, and money.

They are made of Mo-*lyb*-den-um Steel—the hardest and toughest steel known and also the lightest for a given strength. This remarkable hardness and toughness brought out by our process of treating the steel, gives Wood's shovels a long life and uniform quality.

Wood's Mo-*lyb*-den-um Shovels wear very slowly, even under the severe conditions met with in track maintenance work.

In addition to extreme hardness and toughness, Wood's Mo-*lyb*-den-um Shovels are lighter. And lightness is of tremendous importance. Think of the energy saved—and the time, in a day's shoveling.

The straps of Wood's Mo-*lyb*-den-um Steel Shovels are welded securely and cleanly to the blade, making the two parts literally one piece of tough steel. The handle won't split or splinter. It is seasoned second-growth Northern Ash. The edges of the straps and rivets are countersunk, so they won't work loose and injure your fingers.

How Wood's Mo-*lyb*-den-um Steel Shovels more than meet track maintenance needs is told in a special folder. Write for it.

THE WOOD SHOVEL AND TOOL COMPANY
Piqua, Ohio U. S. A.

Wood's Mo-lyb-den-um Shovels

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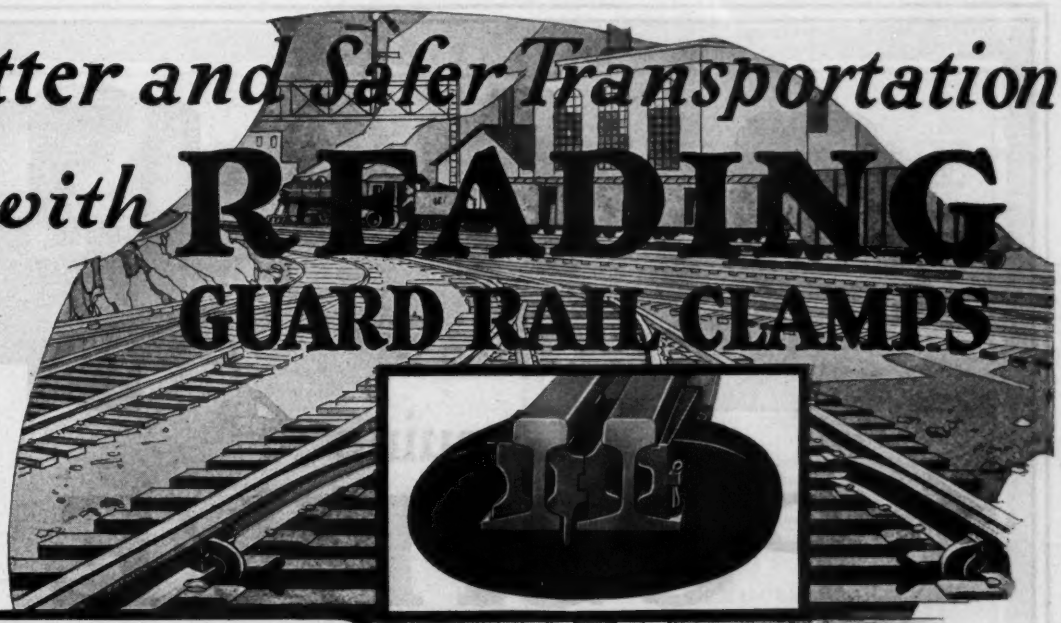

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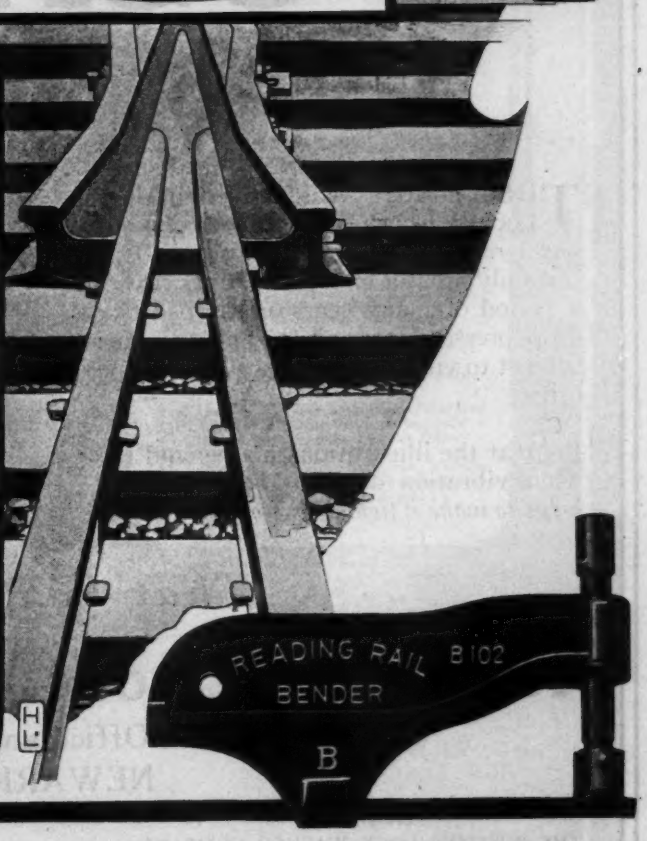

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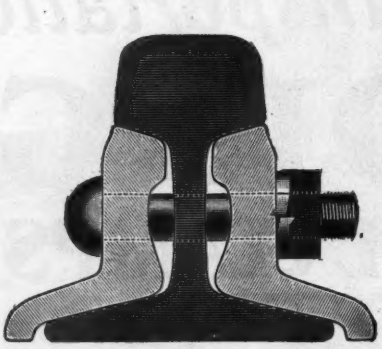

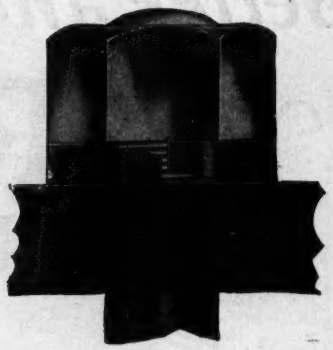

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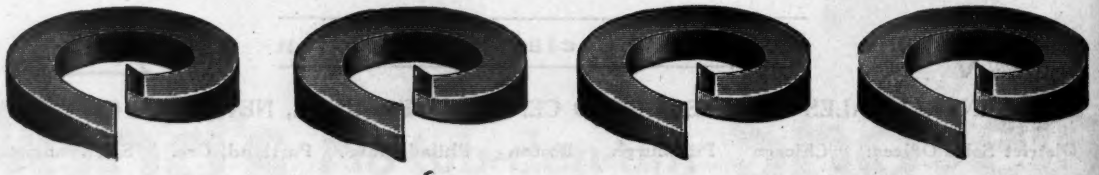

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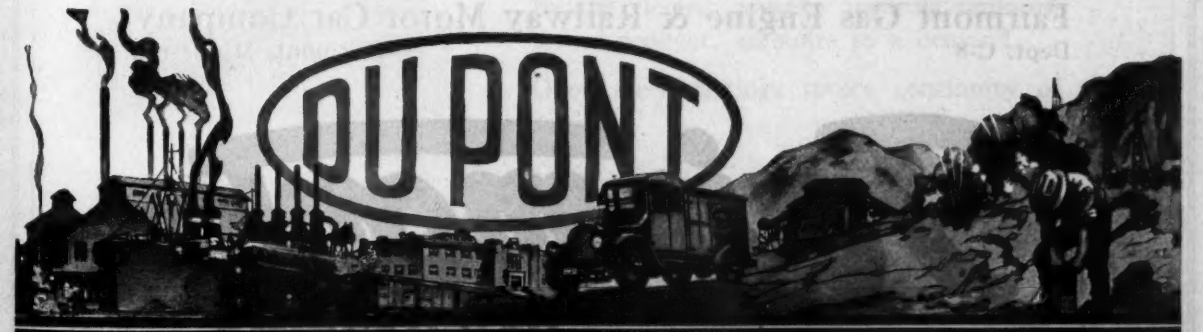

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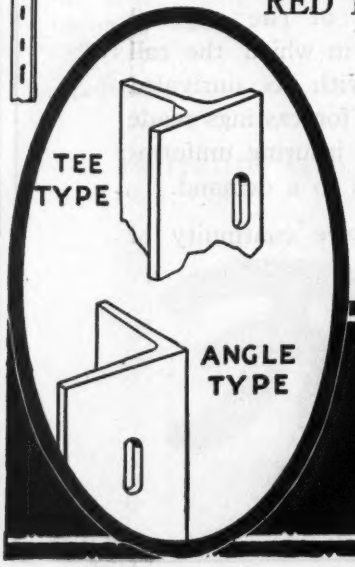

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Railway Maintenance Engineer

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22

CONTENTS

EDITORIALS 273
LETTERS TO THE EDITOR 275
REBUILDING AN UNUSUAL WOOD STAVE PIPE LINE: J. L. CAMPBELL 277
SECTION FOREMAN'S CARELESSNESS CAUSES PASSENGER WRECK 280
MEN MUST APPRECIATE THE VALUE OF TOOLS 281
SPLIT HEAD RAIL CAUSES DERAILMENT OF PASSENGER TRAIN 283
RAISING THE TRACK WILL IMPROVE MAINTENANCE: W. F. RENCH 284
AN ORGANIZATION FOR TUNNEL MAINTENANCE 285
WATCH THE WORK TRAIN RESULTS: CHAS. WEISS 287
A NOVEL USE FOR A CAR BODY 288
REMARKABLE SPEED SHOWN IN BRIDGE RENEWING: S. C. TANNER 289
THE PURCHASE, INSPECTION AND DISTRIBUTION OF CROSS TIES 290
A RIGID DECK TRACK SCALE: C. H. MANN 291
TENTATIVE VALUATIONS ISSUED 292
PRACTICAL HINTS FOR HANDLING EXPLOSIVES 293
RAILWAY AFFAIRS AT THE NATION'S CAPITAL 296
UNUSUAL OLD RAILS FOUND IN TRACK 297
LABOR DEVELOPMENTS OF THE MONTH 298
CUTTING MAINTENANCE COSTS 300
NEW DEVICES 302
WHAT'S THE ANSWER? 304
HOW TO INTERPRET TIMBER TESTS 306
ASSOCIATION ACTIVITIES 306
GUARANTY CERTIFICATES ISSUED 307
THE MATERIAL MARKET 307
GENERAL NEWS 308

Wages have been reduced. The drastic reductions of forces have left the maintenance organization threadbare.

Can You Qualify?

Improvements about to be effected before the war seem farther from accomplishment than ever, expenditures even for bare necessities being miserly. And yet there remains a responsibility of keeping up the roadbed, the tracks and the structures to the same degree of perfection and in as thorough a manner apparently as before. Such is the situation in which the foreman, the supervisor, and their fellow maintenance officers find themselves. As each officer knows very well, the situation on its face is not a pleasant one. On the one hand, unwilling himself to have the property over which he has charge or the work for which he is responsible suffer from neglect, it is irritating to encounter the obstacles placed in his way. On the other hand, though he can perhaps understand why his superior officers insist on the perpetuation of high standards, it seems unreasonable that under the circumstances he should be pressed to maintain them. Added to this he has had the unpleasant experiences of laying off men whom he would like to have retained, and who themselves could ill afford to be out of employment. As a result, he is inclined to look pessimistically upon the whole situation, and permit his spirit to weaken under the stress. He could not make a greater mistake, for in the very stress of circumstances which exist lies his opportunity, his chance to prove his superiority. In every organization there are low grade men and high grade men. It is the way that each meets unfavorable situations that determines whether he is of the one grade or the other. The present situation is admittedly bad, but for that very reason is one that challenges the best in the man and each may well examine himself to see if he can qualify. If equal to the test he will, realizing the opportunity in it for him, welcome it and put his best foot forward.

A New Idea in Timber Design

The report on stresses in timber presented before the American Society for Testing Materials, noted elsewhere in this issue, introduces an entirely new thought with respect to making allowances for impact where timber members are concerned. The statement is in effect that the timber will resist a suddenly applied load better than one that is quiescent. Therefore, the committee proposes a set of stresses for structural timbers which provides for the use of a higher stress in the case of structures subject to impact, such as bridge stringers, than for those which carry a fixed load. As these formulas are to be used in connection with live loadings making due allowance for impact, the net result is about the same as if no impact was considered, which conforms to the present practice of some designers of timber bridges on railroads. While this new principle serves in a measure to confirm the practice of some engineers, it is to be questioned whether those who have been in the habit of taking impact into account are ready to accept this innovation without considerable further investigation.

STILL SOMETHING TO BE THANKFUL FOR

SOME maintenance of way officers have felt that the wage reduction would result in a decline in the efficiency of the track forces. Before the decrease went into effect the wages were clearly above those being paid by almost any one else for common labor, except where entirely artificial conditions prevail, as in the building trades in the large cities. However, before coming to the conclusion that this situation was radically changed by the Labor Board wage cut, it would be well to analyze the present conditions in the other industries to see just how the wages now being paid by the railroads compare with those in the outside industries.

As a case in point, consider the steel industry, which, during the height of war prosperity, offered the most strenuous competition with the railroads in the wild scramble for labor. During the last 10 months wage rates in the steel industry have steadily decreased. Recently a number of the mills in the Pittsburgh district reduced the rates for common labor from 37 cents to 30 cents. In some places men are now employed at 25 cents an hour and even 20 cents, and the overtime rate for overtime after eight hours has largely disappeared.

These reductions in pay are possible only because of unemployment, because many men are glad to take work at the wages offered. The fact that there are now many less employees on the railroads than there were a year ago is a condition typical of all industries. In other words, the competition now is not for men, but for *jobs*. This condition, together with the fact that the present rate paid the track forces is well above the average paid in other industries, should make track work exceedingly attractive, even though the rate was recently cut 8½ cents an hour. Foremen and supervisory forces should not overlook the opportunity to call this fact to the attention of desirable labor in their communities and use it as an argument in bringing their gangs up to the highest possible plane of efficiency.

The Price of Victory

Although it is nearly two years since we emerged victorious from the most terrific war the world has ever experienced, we are still suffering from its effects. While the struggle was in progress the resources of almost the entire civilized world were thrown into the conflict without reserve. Now that it is over, the problem of restoring the old order of civil life is engaging the attention of all. The process of readjustment is slow. None can escape its influence. Labor is the one commodity which everyone has to sell. It enters largely into the cost of everything we consume. Obviously, then, we must accept reductions in wages if the cost of the products of our labor is to fall. Employees in many industries have received drastic cuts in pay and even loss of positions altogether. Railway employees are, in general, more fortunate, for the reductions have been less than elsewhere. However, reductions are a necessity. This is the part of railway men in the process of deflation. Ours has been the victory. We must pay the price.

A NEW DEVELOPMENT—THE MAINTENANCE CONTRACTOR

FROM THE earliest days of railway operation in this country it has been the almost universal practice to do all work incident to the maintenance of tracks and structures with company forces. This has been due in large measure to the hesitation on the part of maintenance officers to adopt any method which might lead to a division of responsibility for safety of travel. The abnormal conditions which have prevailed during the last five years have, however, brought about certain changes in this direction which deserve close attention.

The usual industrial activity which followed the outbreak of the European war led to a most acute shortage of labor, and in turn to the bidding for men by industries engaged in war work in the industrial centers, with the result that railway forces in those localities were seriously depleted. To meet these critical local situations without affecting their wage scales throughout their entire lines, a number of roads adopted the expedient of contracting with outside parties, frequently labor agents, for the performance of all or certain specified maintenance work within these areas at cost plus a fixed percentage for overhead expenses. In this way the contractor was left free to pay whatever rates were necessary to secure the required number of men to perform the work, while these rates did not affect those paid men elsewhere on the road. While this expedient led to excessively high costs in many instances, it did enable the roads to complete much needed work.

More recently this same practice has again come into vogue in certain areas, but for another reason. Under the provisions of the Transportation Act the railways are required to pay their employees the rates specified by the labor board. These rates have been and still are far above those prevailing in most localities. The result is that the railways are required to pay as much as 25 to 40 per cent more than the rate for which they could secure an additional amount of labor. The Transportation Act further charges railway managements with the operation of their properties in an efficient, economical manner. To comply with this latter requirement, a number of the roads are now contracting certain maintenance operations such as the laying of rail on the basis of cost plus a fixed percentage or on a force account basis whereby the contractor charges the road a specified rate for each man employed. The contractor is free to hire men as cheaply as he can in the open market and under the terms of his contract he transmits a large part of this saving to the railway. Under these plans the work is conducted largely in the same manner as it would be conducted by company forces, being handled under the supervision of the company's maintenance officers and frequently under their immediate direction.

A third form of contracting is also coming into vogue in which certain specified work is carried on and paid for on the basis of unit prices. For a number of years certain roads have contracted such operations as the laying of rail, the placing of ballast, the renewal of ties and similar work capable of ready measurement. As cost data are becoming more generally available, a number of contractors are entering the field, prepared to undertake such work at fixed prices per unit of work. With suitable precautions this method has much to commend it. It focuses responsibility for the economical conduct of the work on the local contractor who has the incentive of personal gain to stimulate him to the most economical performance of the work, while through proper competition he is forced to

divide these savings with the railway. While the cost plus and force account bases of contracting are enabling the roads to effect marked economies at the present time, they are more or less temporary expedients to meet the present abnormal conditions, and will not offer the same possibilities when conditions become stabilized. The practice of contracting upon a unit price basis, however, does offer a permanent opportunity for economy if suitable restrictions can be devised to protect safety of travel, and the experience of the roads which have tried this method most freely indicates that such restrictions can be developed. Because of the difficulties of supervision and the lack of personal incentive which are inherent to a large organization, maintenance officers are warranted in giving serious consideration to the possibilities for the contracting of much maintenance of way work.

CONSIDER THE TOOLS

ONE could almost say that there is a conspiracy of circumstances for the purpose of making it difficult to conduct maintenance of way work efficiently. The wide distribution of the work and the forces which make general supervision difficult, the diversified operations which must be performed by each workman, and the varying conditions that preclude ready comparisons of performance by the several gangs, all militate against the best results.

Consider the tool problem—if all the tracks in a supervisor's district were concentrated in one yard it is easy to see how a great economy could be obtained in the use of tools. Conditions then would be comparable to those in a equipped with suitable tamping tools, etc. Furthermore, a tool room could be provided where the tools could be properly cared for and charged out against each man. Thus there would be a great reduction in the number of tools required, increased skill on the part of men employed in doing a limited number of operations, and a concentration of the inspection and accounting of the tools.

But this is an idle dream as compared with the stern reality that confronts the average roadmaster. Each of his gangs must be complete within itself. It must have enough tools of each kind to do all classes of work encountered in track maintenance. As a consequence the railroads must carry a large investment in tools which are large shop. The track men could be divided into gangs of bolt tighteners equipped with wrenches, spike drivers equipped with mauls, tie renewers supplied with tongs and shovels, track liners armed with lining bars, track raisers used only a very small proportion of the time. The care and distribution of the equipment must be delegated to the foreman, who, under ordinary conditions, must conduct the work in such a way that it is impracticable to hold the individual track man responsible for the loss or injury of the tools with which he is entrusted, and without any tool room facilities for keeping the tools in repair.

To state a problem is not to solve it. It does, however, serve to draw attention to the enormous opportunities for waste in the use and distribution of the tools required by the maintenance of way department. The importance of this matter and some of the measures which may be instituted to overcome deficiencies are presented elsewhere in this issue in a series of articles contributed by practical maintenance of way men.

ATTEMPT TO WRECK TRAIN.—On July 14 a New York Central train of 14 American Express Company's cars jumped the track two miles west of Wiloughby, Ohio. An investigation disclosed the fact that spikes had been pulled and tie plates removed evidently in conformity with a deliberate plan to wreck the train.

LETTERS TO THE EDITOR

LONGITUDINAL SHEAR IN STRINGERS

Chicago.

TO THE EDITOR:

Sub-committee 2 of the Committee on Wooden Bridges and Trestles of the American Railway Engineering Association has before it the preparation of plans for trestles to be submitted to the next convention for approval. One of the subjects over which there appears to be a wide difference of opinion is the stress to be permitted in longitudinal shear. The stresses under this head adopted by the last convention are 125 lb. per sq. in. for dense pine and 100 lb. per sq. in. for Douglas fir. In practice the different railroads permit as high as 220 lb. per sq. in. in design for dense pine with no allowance for impact. This wide disparity between theory and practice is explained by some as due to the way longitudinal shear is computed, that the usual method is to apply the load at the same point as when computing vertical shear, that there will be no longitudinal shear where there is no deflection, and that a load applied to determine vertical shear will never cause longitudinal shear, that the timber will fail from direct compression long before longitudinal shear will occur. It is contended that to obtain longitudinal shear the load should be applied as in the tests at the laboratory or in the manner which will produce maximum deflection. The imposed load of an engine moving across the deck of a trestle is not fixed. The committee would like to have the views of as many as care to write either direct to the American Railway Engineering Association or to the *Railway Maintenance Engineer* on this subject. Is the accepted method of figuring longitudinal shear just to the timber and will it give us a true indication of the strength of the timber to resist that stress in service? Taking panel lengths of 12 ft. and 16 ft. and the engines now in use, where should the engine be placed to impose the maximum load in longitudinal shear?

A. M. VAN AUKEN,
Chairman Sub-Committee.

SYSTEMATIZE YOUR WORK

Hamlet, N. C.

TO THE EDITOR:

In my opinion the day has long since passed when we can place a foreman in charge of a section or extra gang and say to him, "Here it is, deliver the goods. It is your job." Rather I believe that the time is here when there must be a system of detailed working rules and conditions. I wish to discuss this question from the standpoint of those of my own rank, who are directly in charge of and responsible for this class of work. In my judgment it is the duty of a roadmaster or supervisor to be so familiar with the conditions on his district that he will know off-hand, at all times, the amount of material required to do any piece of work under consideration. And if possible to do so, he should accompany work trains that are assigned to him for the distribution of such material, to see that the material is properly distributed and thus avoid reloading and handling, and to see that the best possible results are gotten from such trains. Much time, energy and money can be wasted by the improper handling and distribution of material, for when it is done wrong it involves two costs, (1) for doing it wrong, and (2) to do it right, which must eventually be done.

It is my belief that every roadmaster and supervisor should so study his work that he can at all times picture in his mind an imaginary lineup for each gang under his supervision. In other words, he should draw an imaginary work sheet for each section and extra gang and should go over this with each foreman and rehearse it with him until the foreman becomes so thoroughly familiar with what he is expected to do that he can plan his intended movements at least six months in advance. In so doing there would be little chance for lost motion, due to the foreman not knowing what he is going to do next.

It is true that such a lineup would necessarily be broken at times by storms and accidents, but when such trouble has been cleared up a well trained foreman will readily fall back in line with previous instructions. By this method a roadmaster can see more readily when a foreman is falling down on the work, and is in a better position to take immediate action to bring him up to the standard.

It is very discouraging to a foreman, and especially to one who is not well seasoned, to be at a loss to know just what move to make next to the best advantage. It is my idea that a roadmaster or supervisor should get his plans so completely formulated in his own mind, and the men under him so trained and lined up, that he could readily say at what point each foreman was working and what he was doing on any day of the week.

This may sound like something impossible or impracticable, but I believe that this plan will largely overcome lost motion, will increase the amount and quality of the work, and will encourage the foremen. When a man knows that he is doing right he goes at it without fear. Once you get a set of men trained to know exactly what they should be doing and the amount of work they should accomplish each day they will put forth every effort to meet the expectation. There is nothing more encouraging to a gang of men than to let them understand clearly exactly what they are expected to do.

I believe that the same plan can also be applied to bridge and building organizations.

J. R. MORGAN,
Roadmaster, Seaboard Air Line.

SELECTING PAINT MATERIALS

Cheyenne, Wyo.

TO THE EDITOR:

Paint materials used in the maintenance of railway buildings and structures are usually furnished by the stores or purchasing departments of the railroads and mixed according to specifications that vary in excellence and frequently possess only the doubtful quality of cheapness. That it is poor economy to purchase or use the inferior or cheaper grades of material is generally acknowledged, but if good results are obtained from adulterated or substitute materials, and they demonstrate their worth, the use of such materials should be encouraged where profitable.

The greatest abuse of paint materials usually is due either to poor packing or handling or both, and usually occurs prior to the time it reaches the hands of the master painter or his men. The size and style of the containers of the paint material used have an important bearing on the wastage. The apparent economy in buying some material in large containers is often more than nullified by the wastage that ensues from unused and dried out remnants. This occurs most frequently in the highest-priced materials and especially those that are used only occasionally. Much wastage is due to ignorance of the proper method of handling or to indifference to improvement in this respect and most of it could be avoided by the substitution of smaller containers in place of those now generally used. Mixing colors especially should be bought in containers of sizes ranging from those quite small to larger ones, according to the requirements of the work.

The practice of packing expensive paints, varnishes, oils, turpentine, alcohol and other liquids in wooden or fiber containers results in exposing them to the elements in all kinds of weather and storing them in places where they are subjected to other pernicious influences, causing large losses through leakage or deterioration of materials by evaporation, and hardening of some of their component parts. It is hard to understand why those who advocate the use of such containers for this class of material insist that the cheap, crude oils and softening compounds need metal containers.

The care of paint stock, which includes hundreds of different articles, requires ability of a high order and an intimate acquaintance with the proper methods in vogue in storing and handling them. Adequate facilities should be furnished to enable all material to be protected from the weather and fire hazards should be avoided as much as possible. Paints and varnishes subjected to extreme heat and cold do not retain their original good working qualities. The vehicles used do not keep the pigments in proper suspension when subjected to extreme heat and in time settling and separation of the inert material and pigments ensues. The resultant dissatisfaction, caused by improper conditions in storage, could be avoided to a great extent by better co-operation by the manufacturer, storekeeper and master painter.

The use of many of the injurious substitutes introduced during late years in paint manufacture should be discontinued and material that has been unable to prove its merits should be discarded. In the exploitation of some paints unusual stress is being placed on the necessity of using only certain thinners and vehicles in mixing or thinning them. Admitting that there may be much excellence in many of these products and that different formulæ are necessary to produce the desired results that are claimed for them, it should be remembered that railroad work as a rule requires only the simplest of paint mixtures and that it is possible to dispense with the use of any material possessing special peculiarities that will make it immiscible with other mixtures. The creation of a mystifying halo around paint products of this kind has resulted in more or less diffidence on the part of practical painters when this class of material is discussed and they question the advisability of having a variety of such special paints and mixtures on hand, when improper or ignorant use of them admittedly would be disastrous to the work being done.

If the paint manufacturers in their researches have discovered a new and valuable vehicle for paint ingredients or have a new pigment that has the necessary qualities to compete in the open market with accredited material, they should be encouraged to announce such discovery openly and permit others through experiment and trial to improve and increase its usefulness and excellence. Experimental tests and long usage of all new paint material is essential before it can be classified properly as to its utility or durability. To prove its worth and usefulness, sufficient time must be allowed to observe the effect produced under practical conditions and if any superiority is evident after such trials and tests, its acceptance as a standard article is a matter of course, and its use marvelously increased in a short period.

CHARLES K. COLLENBURG,
Maintenance of Way Master Painter, Union Pacific.

The Nogal Reservoir, from Which the El Paso & Southwestern Obtains Its Water Supply Through a 141 Mile Pipe Line

REBUILDING AN UNUSUAL WOOD STAVE PIPE LINE

El Paso & Southwestern Is Now Renewing a Conduit 141 Miles Long Which Supplies an Entire Engine District

BY J. L. CAMPBELL
Chief Engineer, El Paso & Southwestern, El Paso, Texas

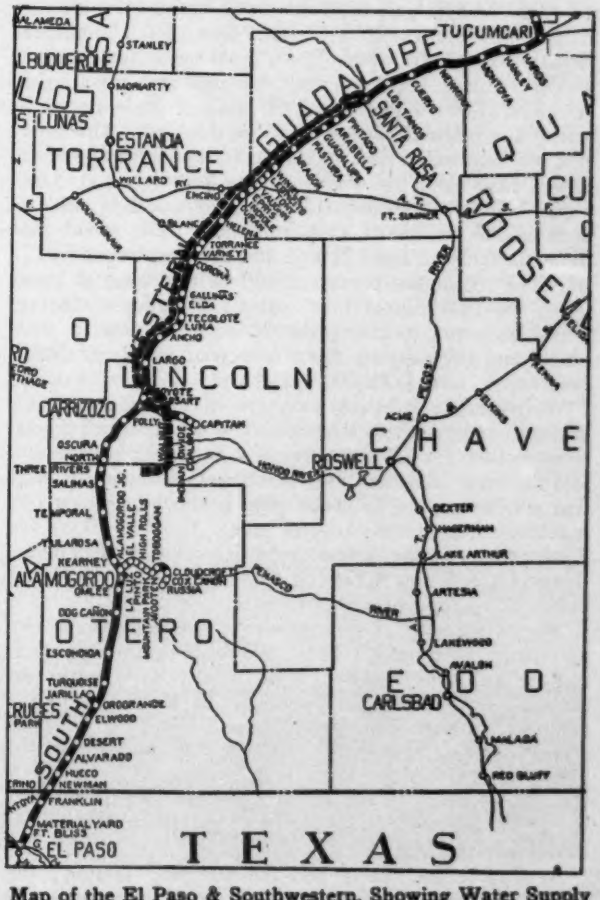
ORIGINALLY, the entire water supply of the El Paso & Southwestern System was from wells. From Carrizozo to Santa Rosa (128 miles) the water carried more than 100 grains of incrusting solids per gallon, could not be made suitable for steam by treatment, and was so bad that the growing traffic could not be successfully handled on that district.

A better water supply was imperative. This was found in Bonito and Eagle creeks, small streams on the east slope of White Mountain situated 30 miles southeast of Carrizozo and fed by springs and snow, the mountain being 12,000 ft. high. This water is good, having less than 10 grains of incrusting solids per gallon. It is conducted to and along the railroad in a pipe line shown by the dotted line on the accompanying map.

White Mountain is on the divide between the Rio Grande and the Rio Pecos. The point of water diversion lies in the Rio Pecos drainage on the east slope 7,750 ft. above sea level, from which the pipe line runs around the northeast base of the mountains 12 miles to Nogal storage reservoir, also situated on the crest of the divide 7,100 ft. high, from which the line drops into the Rio Grande basin to the railroad at Carrizozo and Coyote to elevations of 5,400 and 5,800 ft., respectively—a total of 46 miles of pipe from source of water to the railroad.

From Coyote to Corona (36 miles along the railroad) the water is pumped up to an elevation of 6,750 ft. (a 950-ft. lift), Corona also being on the crest of the divide between the Rio Grande and the Rio Pecos. From Corona to Pastura (the present terminus of the line), 59 miles along the road, the pipe drops back into the Pecos basin to an elevation of 5,300 ft. Eventually it will be extended 20 miles to Santa Rosa on the Pecos, the water of this stream being unsuitable for steam—a total distance of 150 miles from the source of water supply.

The accompanying condensed profile shows the point of origin, the Nogal reservoir, the pumping stations at Coyote (the foot of the hill in the Rio Grande basin), and at Luna (half way up the hill), the Corona summit, the hydraulic grade lines, the gravity sections, the pumping sections, the termini at Pastura and Santa Rosa, elevations and mileage, and the pipe diameters of the original line and the renewal line. Locations of controlling gate valves, blow off valves, relief valves and air valves are not shown. There are several hundred automatic air valves, one on each profile summit.



Map of the El Paso & Southwestern, Showing Water Supply Line

In the original line there were 117 miles of wood, 6 miles of steel and 18 miles of cast iron pipe. Diameters ran from 16 to 4 in. The maximum pressure is 130 lbs. for wood and 300 lbs. for iron pipe. This line has a capacity of 3½ million gallons daily from source of supply

Weir Measuring Bonita Creek Water Into Nogal Reservoir

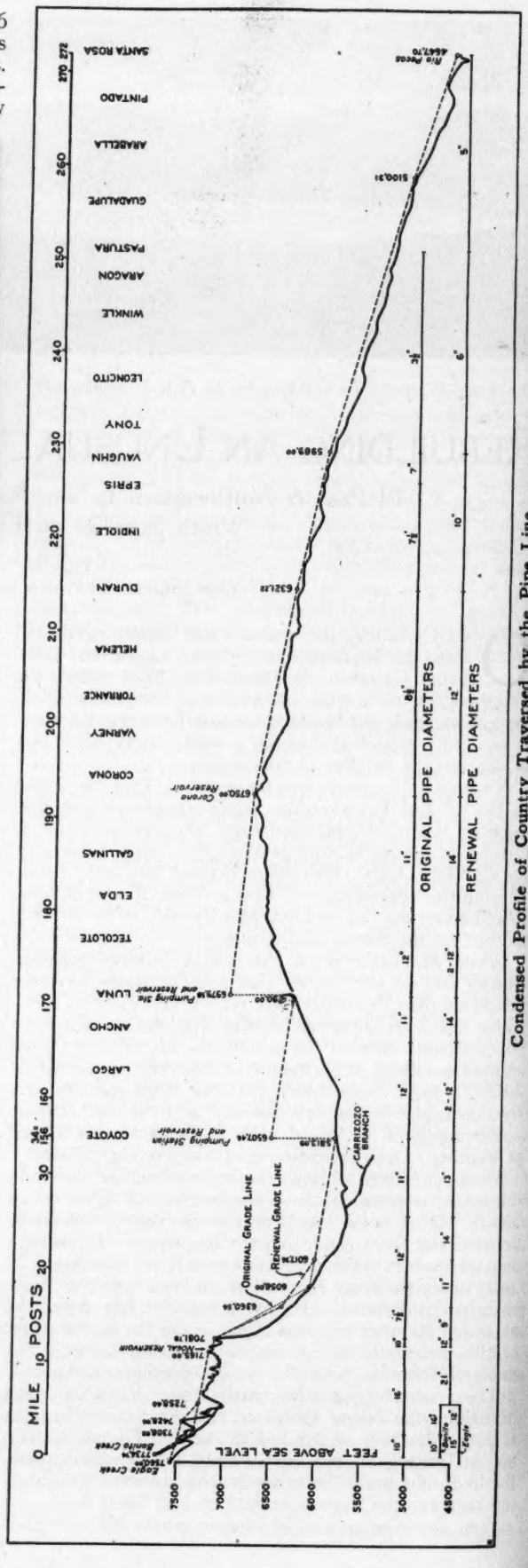
to Nogal reservoir and 1½ million from the reservoir to the railroad. The reservoir is a natural bowl-shaped basin in the summit of the water shed 1,700 ft. above the railroad. It has a capacity of 400,000,000 gal. up to the lowest place in the rim of the bowl. This can be increased to 1,000,000,000 gal. by three small embankments.

The pipe line was built 13 years ago. The annual peak demand on it now equals its original capacity. To provide for future requirements, a renewal and enlargement program to be completed in 1930 has been inaugurated, by which the original capacity will be doubled. The lower line on the profile gives the diameters of the proposed enlarged line from the source to the Rio Pecos at Santa Rosa. This will include 137 miles of wood, 6 miles of steel and 36 miles of cast iron pipe. The wood pipe diameter will run from 21 to 5 and the iron from 15 to 12 in. The maximum pressures will be the same as above given for the original line. About 25 miles of the renewal program, including the 21-in. wood pipe, is completed and the capacity from source of supply to Nogal reservoir is now 7,000,000 gal. daily.

Weight and cost of cast iron pipe in isolated and mountainous country led to selection of wood pipe for original construction for all pressures not in excess of 130 lbs. and the same considerations still impel adherence to original conclusions. The wood pipe is the kind known as machine-made spirally-wound pipe. In Vol. 70 of the Transactions of the American Society of Civil Engineers there is a full description of the original line, including velocity and leakage measurements.

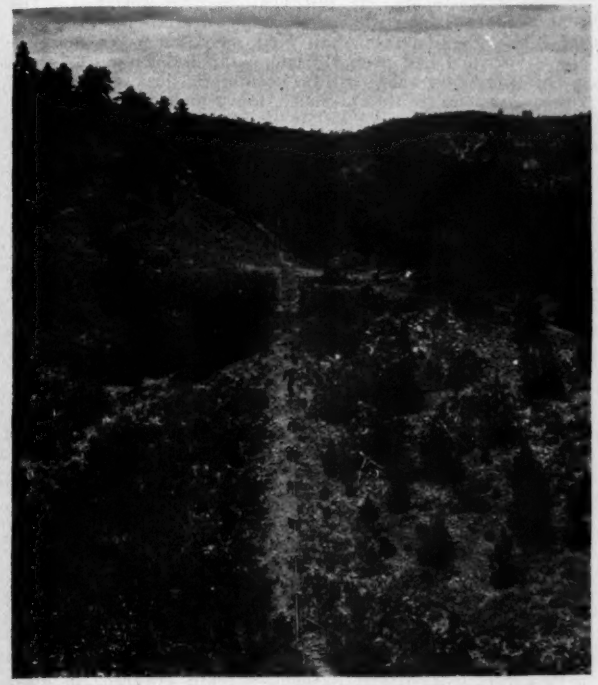
The wood pipe is now made to the company's own specifications, those for 14-in. 100-lb. pressure pipe without collars being given. Cast iron collars, when required for the joints, are made in El Paso also to the company's design and specifications. The iron collar is considered best, especially for high pressure, but wood collars under 130 lbs. are serving satisfactorily. All of this pipe so made is remarkably tight, the average leakage therefrom not being in excess of 25 gal. per mile per inch of diameter per day.

At Coyote and Luna (on the pumping section) the maximum pump pressure is 300 lb. and cast iron pipe is used from each pumping station up the line to the point



Condensed Profile of Country Traversed by the Pipe Line

where the pressure in the pipe is 130 lb., from and beyond which wood pipe is used. Water hammer on these pumping mains is eliminated by large air chambers in the form of a riveted steel cylinder 5 ft. diameter and 15 ft. long, mounted in horizontal position over and connected to the main by a 12-in. tee just outside of the pump house.



The Eagle Creek Pipe Line Crossing the Mountains

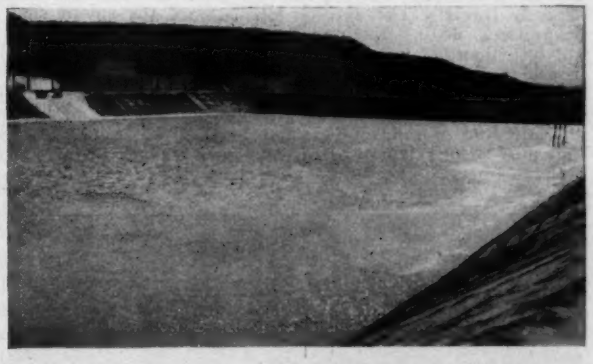
These cylinders are kept charged with air by small automatic air charging devices attached to the water end of the pumps and actuated by the piston movement.

Each pumping station consists of two duplicate pumping units, one unit being in reserve. The units are operated alternately, usually in three-month periods. Additional units will be added as required by increasing pumpage. The pumps are Nordberg, cross compound, condensing, crank and fly wheel pumping engines having a contract duty of 135 million foot lb. per 1,000 lb. of dry steam at 150 lb. pressure. The boilers are Sterling water tube with superheaters. Each plant is lighted by a small electric light unit.

At Carrizozo, Coyote, Luna and Corona, there are service reservoirs each of 2½ million gallons capacity to regulate the delivery of water. They are constructed half in excavation and half in fill and are concrete lined.

The renewal and enlargement program described was not put under way because of necessity for general renewal of the original line at this time. The original wood pipe could be maintained at reasonable expense for the next ten years, perhaps longer, but such a program would finally require the renewal of more than 100 miles of pipe in limited time with attendant risk and concentration of expenditure.

About the only material limitation of the life of wood pipe properly designed, made and laid and kept saturated is the corrosion and consequent failure of the steel banding. The banding on the original pipe herein described



The Corona Service Reservoir, Showing Concrete Lining

is an ungalvanized flat steel band protected only by a heavy coat of asphalt. Failure of this band began in the fourth year, but has never been serious. During 1920, the twelfth year, the repair of banding so failing required an average of 15 individual ⅜-in. round bands of the kind used on continuous stave pipe per mile of pipe line. This was a quite nominal expense. A failure of the banding is indicated by a leak which is usually discovered and stopped by application of a few round bands without taking the pressure off the pipe. The round galvanized banding, also covered with asphalt, will last much longer and the pipe so made should be maintained at a reasonable expense for 50 years, other conditions being right.

The investment in this water supply was necessarily large, but within two years the reduction of operating cost due to the better water was greater than the investment. Train tonnage increased 33⅓ per cent within 30 days after use of the new water supply began. One of the marked results was a psychological one. Under the disastrous conditions prevailing with the bad water every one on the district was discouraged and the esprit de corps was gone. In 30 days it was more than recovered. Everybody developed a high batting average and the operating district was converted from a liability to an asset.

Another View of Nogal Reservoir

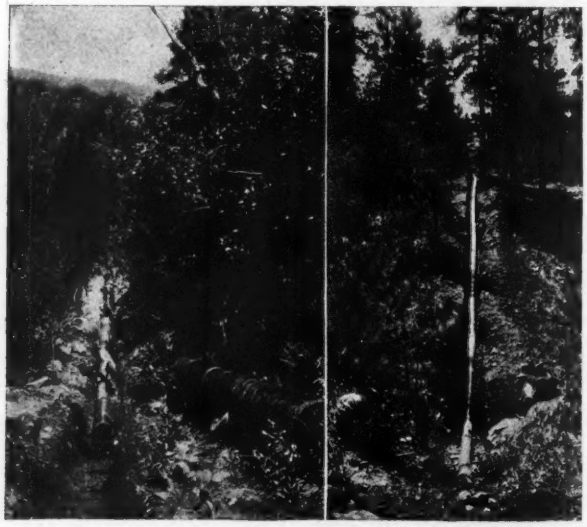
This Bonito water supply also serves the Santa Fe divisional terminal at Vaughn, where the Santa Fe crosses the Southwestern.

SPECIFICATIONS FOR FOURTEEN-INCH WOOD PIPE WITHOUT WOOD COLLARS

The following are the specifications under which the pipe line is being built:

1. This pipe shall be wood stave pipe having an interior diameter of 14 in. without wood collars, pipe being spirally wound with steel wire. The finished thickness of the stave shall be 1.25 in. and the wire shall be No. 2 American Steel & Wire gage having a sectional area not less than .05 sq. in. On each end of each piece of pipe a spigot having a length of 4 in. with end cut square and the outer corner chamfered shall be turned. The exterior diameter of the spigot shall be precisely 16 in. Each piece of pipe shall have a length not less than 9 ft. 6 in. nor more than 20 ft. The average length shall be not less than 14 ft.

2. The staves of the pipe shall be made of the best grade of clear, live, sound, straight-grained yellow fir thoroughly dry and free of sap, knots, shakes, splits and other defects that might cause failure of the staves or leakage through or between them. The staves shall have their faces dressed



Other Views of Eagle Pipe Line Crossing Mountains

to concentric circles. The edges of the stave shall be dressed on lines radial from the center of said circles. One edge of each stave shall have a V-shaped groove on or approximately along its center line. The other edge shall have a corresponding V-shaped bead slightly larger than the groove. Each stave shall be in one piece without joint or splice. In turning the spigot specified in paragraph one, the tool shall not cut below the surface of the spigot at the shoulder or elsewhere. The entire exterior surface of the spigot shall be true, unbroken, perfect and precisely to the diameter required.

3. The steel wire shall be made of open-hearth steel. It shall have an elastic limit not less thin 35,000 lb. per sq. in. It shall be thoroughly galvanized. The galvanizing shall consist of a coating of zinc of uniform thickness which shall withstand without being removed or showing a copper-colored deposit four one-minute immersion tests in a solution of sulphate of copper crystals and water the specific gravity of which shall be 1.185 and the temperature of which shall be from 60 to 70 deg. F., the galvanizing to be washed and wiped dry immediately after each immersion. The wire shall be tightly wound on the pipe beginning and ending with not less than two complete parallel and abutting turns at each end of the pipe and throughout shall be securely held by an ample number of galvanized steel lugs and staples. Splices in the band shall be made so as to develop the full strength of the band. The banding on the pipe shall begin and end ½ in. from the shoulder of the spigot. The pitch or spacing of the bands on the pipe shall be 0.875 (⅞) in.

4. When made as above specified, each piece of pipe shall have its exterior, except spigots, thoroughly covered by a heavy coat of high-grade asphalt of the quality used by the California oil companies for coating steel pipe. The asphalt shall have a high melting point, and it shall be applied at a higher temperature in a fluid condition and immediately be rolled on a bed of fine dry sawdust while hot. The coating shall be thick enough and shall completely embed and cover the banding of the pipe, repeating the operation of applying the asphalt and rolling on the sawdust as often as may be necessary to secure the thickness of coat specified. The coat must not cover any part of the surface of the spigots.

5. The manufacturer shall guarantee that when made as above specified and properly laid without damage and thoroughly saturated, there will be no material leakage from this pipe when under the pressure for which it is properly designed.

6. The manufacturer shall be responsible without cost to the buyer for the proper loading of all pipe for transportation in such manner and by the use of such spacers as will hold each piece of pipe from contact with every other piece. Any pipe rendered unsuitable for use through damage due to defective loading shall be rejected at the expense of the manufacturer.

7. The manufacturer shall give the buyer's inspector all necessary facilities for full inspection in all stages of selection of material and manufacture of this pipe.

SECTION FOREMAN'S CARELESSNESS CAUSES PASSENGER WRECK

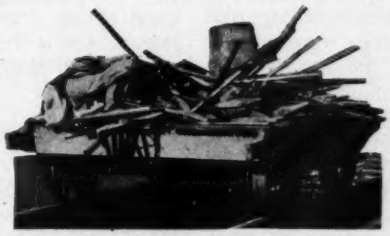
A PASSENGER wreck which occurred near Forest City, Ark., on May 12, 1921, and in which one employee was killed and four passengers and two employees were injured, constituted the second instance in less than two weeks where a bad wreck resulted from the failure of a section foreman to comply with the rule that he must not permit his switch key to leave his possession and must personally open and close all main track switches operated by him. The other instance is that described in the July issue of the *Railway Maintenance Engineer,* where a Norfolk & Western passenger train entered an open switch near Welch, Va., on May 3, and collided with a string of coal cars, killing six passengers and injuring 42.

The more recent accident occurred about 8-10 mile west of Forest City at a turnout when a St. Louis-Southwestern passenger train traveling eastbound over the Chicago, Rock Island & Pacific tracks at a speed estimated at from 25 to 50 miles per hour struck the open switch. The investigation disclosed the fact that this switch had been left set for the spur track and that it had also been run through by a westbound train before the accident occurred. After the accident the switch was found to be lined and locked for a movement to the spur track with the target displaying the proper red indication. Earlier in the day the section foreman had given his switch key to one of his men with instructions to obtain necessary tools for relaying some rails on a track which leads off the spur and to take a motor car and push car to that point. Although the section man was positive that he had closed the switch all indications pointed to the fact that he had failed to do this. Accordingly, although the engineer of the train, who was killed in the accident, was held responsible for not having observed the red target of the switch in approaching the switch, the section foreman was also held responsible for having violated specific instructions regarding the operation of all main line switches.

INTERNATIONAL EQUIPMENT ASSOCIATION.—The establishment of an International Railroad Equipment Association for the purpose of financing the sale of equipment to foreign railroads has been proposed by the American Committee on Land transportation for consideration by the International Chamber of Commerce. It is believed that such an organization will accelerate the restoration of commerce.

MEN MUST APPRECIATE THE VALUE OF TOOLS

Economy in Their Use Will Be Obtained Eventually



But Employees Should Understand the Need for Conservation

THE MONEY paid for new tools purchased to make up needless loss or destruction represents a waste. Of equal importance is the loss of effective effort resulting from the use of improper or inefficient tools or the slovenly, careless or unskilled use of good tools. These simple truths are generally recognized and observed in some fashion nearly everywhere, but owing to the large part taken by personal equation, the difficulty of making the men understand the necessity for care and the complications involved in any system of tool accounts, there is room for great improvement in the use of tools on the railroads. Because of the importance of this subject at a time when the railroads must practice strict economy, we are calling renewed attention to this matter by the presentation below of discussions by five maintenance officers who have given this subject special thought.

THOROUGH RECORDS ARE ESSENTIAL

By Coleman King*

Late Supervisor, Long Island Railroad, Jamaica, N. Y.

THAT THERE IS waste in all walks of life, be it on railroads, in industries or shops, on the farm and even in the home, is unquestionably true to a greater or lesser degree. It is invariably due to carelessness, inefficiency and lack of economical ambition on the part of the individual, superinduced by the possession of a surplus, or being enabled by an easy mode to replace the articles misused, especially when it involves no cost to the party concerned. It is clear from this that the doctrine on economy should be taught more generally. This is especially true on the railways of the United States, particularly at this time. Economy and the elimination of waste should be the watchwords. One of the commonest wastes in the track department entailing unnecessary expenditures, results from the careless handling, misuse and loss of tools. To reduce this waste to the minimum, closer supervision on the part of the roadmaster or supervisor in the care of tools used by track gangs, is imperative.

As surplus is an incentive to waste, only the required tools should be furnished each gang. New or repaired tools should be given only in exchange for an equal number of similar tools, thus always maintaining the same amount of stock in each gang, unless the force is increased or reduced, in which case the stock on hand should be apportioned accordingly.

Each foreman should make a monthly tool report showing thereon the number and kind of tools on hand on the first of the month; the number and kind received during the month; the number and kind turned in in exchange (giving an explanation of the cause or defects in tools turned in), also the number and kind of tools on hand at the end of the month. This report, when received in the roadmaster's or supervisor's office should be checked over very carefully and any errors or omissions discovered should be taken up promptly with the foreman involved.

After the tool reports have been checked over and found correct, the number of tools on hand in each gang at the end of the month should be copied in ink in the roadmaster's or supervisor's office on the repore for the succeeding month on the line reading "on Hand First of Month" and forwarded to the foreman of each specific section or gang. The balance of the tool report should be filled out by the foreman without any alteration or erasure of the heading as filled out in the roadmaster's or supervisor's office.

Each foreman should be trained to take a special interest in the care of his track tools, and should so educate his men in order to insure their own safety from injury caused by defective tools or handles insecurely applied, and prevent the improper use of tools, for instance, as to prevent the improper use of adzes by first removing with a shovel and broom all stone or gravel on the tie surface and thus preserve the adze edge—in fact, to use all tools properly for the purpose for which intended.

In addition to and as a check on the correctness on tool reports as rendered by each foreman, an inventory in the field should be taken periodically. Owing to the fact that different kinds of tools are required for different localities, it is not feasible to propose a standard tool list. Where a close check is kept on tools through a monthly tool report and inventory, the loss of tools is practically nil, as each foreman realizes that he is called to account for any losses and will be more watchful in guarding against loss than if no accurate check were kept.

It is often necessary to work several gangs together on special work, in which case it may happen that in gathering up their tools at the quitting hour some gang gets more than its own tools, leaving other gangs short. In all such cases each foreman should be instructed to report immediately the kind and amount of tools short or over, so that an adjustment may be made by the supervisor or roadmaster.

An important factor in producing interest in the care of track tools is brought about by insistence on neatness in the racking of tools in tool houses which should always be kept neat and tidy. Insistence on the old maxim that cleanliness is next to godliness tends towards instilling ambition in the individual whoever he may be.

EMPLOYEES SHOULD SHARE COST OF TOOLS

By W. F. Muff

Roadmaster, Atchison, Topeka & Santa Fe, Newton, Kan.

IN OPENING this discussion I would like to relate a little experience I had a number of years ago. I had charge of a piece of construction work, when labor was plentiful and tools scarce. At that time we were paying $1.25 per day for ten hours' work and ran about thirty miles with a construction train. We were on the job at seven a. m. and never left until six p. m. The work being done was taking dirt out of cuts to raise a fill on each side of a bridge, which had been raised and renewed. Picks and shovels were the principal tools and from 95 to 125 men were employed. We found shovels being broken by the score, by the men misusing them. It got to the point where many men were idle, wanting to work, but

*Coleman King died June 18.

had no shovels and the result was that ofttimes men were sitting around all day without pay because they had broken their shovels. I finally put the proposition up to them that if they would purchase their own shovels I would put them to work, with the understanding that when the job was completed if their shovels were in good condition the railroad would take the shovels off their hands and reimburse them for the amount they cost. The result was that we had no more broken shovels. Care was taken that they were not struck against the side of a car to free them from the dirt that stuck to the shovel. Furthermore, I got more and better service out of the men and when the job was completed, every shovel was accepted by the railroad and the men were paid what the shovels cost them.

I wish space would permit me to explain the reasons why I believe certain kinds of track tools should be furnished by the men, thereby saving vast sums of money to the railroad companies, by eliminating the gross carelessness in the willful breaking of track tools. I do not wish to be misunderstood as favoring the placing of any additional hardship on the foreman or laborers, nor do I wish to advocate any theory that may lead foremen and laborers to shrink from assuming any responsibility for tools and material in their charge. The man who will not assume the responsibility which goes with his position is not worthy of his hire. When men have a personal interest in the work they perform because of being part owners in the equipment used, then and then only will careless waste be eliminated.

My idea is that only such tools as are most commonly broken through carelessness or willful neglect should be charged up to the foreman in charge and he in turn should charge out to his men, as they are employed, not over 50 per cent of the value of such tools, the railroad company assuming the other 50 per cent. Such tools as shovels, hand saws, hatchets, braces and bits, tape lines, lanterns, flags and other minor tools, which are more or less subject to theft. Such tools should be issued and charged against each man as he is employed and deductions made from his first month's wages, the employee being given a receipt with the assurance that, when he should leave the service at any time, he would be reimbursed for such amount as he had been charged with. The railroad company should replace all tools worn out and defective after first issued, the employees standing the 50 per cent loss on all tools carelessly or willfully destroyed or lost.

Many roads require certain crafts, such as bridge and building men, to furnish practically all the tools they use, without replacements or renewals when worn out and broken, but no road, as I understand, requires track men to do this. My conviction is that they should be required to. I cannot see where this practice will work any hardship on track men, but it will educate them to care for and save the equipment they use. The fact that the railroads have furnished all tools free has encouraged waste, carelessness and indifference, for which the companies have paid dearly and will continue to unless some steps are taken to revise the present custom. I am also confident that if a system of this kind is inaugurated a better class of material will be used in the manufacture of track tools in time, as the employees will insist upon guaranteed tools.

To inaugurate a system of this kind would cost only a trifle compared with the large sums of money now spent for tools that are destroyed through careless indifference. At the same time the railroads could well afford to offer some inducement to foremen who take the best care of their tools. Tools should be inspected monthly by some competent appointed supervisor of tools, say one for each district superintendent's territory, whose duty would be to inspect tools broken and issued and rate the gangs. I believe his salary would be saved many times and in a very short time all employees would come to look at this great saving crusade as we did when the Safety First slogan became the password. There are a few things impossible, but many improbable. Is this plan worth while trying?

TOOL ECONOMY REQUIRES SUPERVISION

By J. B. MARTIN
Supervisor, New York Central, Elkhart, Ind.

ALL RAILROADS are now looking sharply to every item of expense on their lines, as it is imperative that operating expenses must be reduced to a minimum, consistent with good service. One of the large items of expense in maintenance of way work is track tools. To keep this expense within reasonable limits requires close watch on the part of the supervisory forces and some well defined plan and system for the handling and caring of the tools.

After careful investigation the proper number and kind of tools for each gang should be determined and that number furnished and no more, holding the foreman responsible for the care and condition of the tools in his gang. When a new tool is furnished an old one should be turned in in its place. Records should be kept of the tools with each gang and of the number furnished. All tools should be marked and each gang should have a distinctive mark for its tools to prevent confusion with tools from other gangs. Old tools that can be repaired or salvaged should be sent to the shop and when repaired placed in stock and reissued on requisitions.

In order that a check can be kept on the tools and their condition frequent inspections should be made by the supervisory forces. To facilitate this and prevent the confusion that sometimes exists all tool houses should be arranged with racks and shelves so that the tools can be kept convenient, in good order and in plain sight. No surplus should be allowed to accumulate. The use of garrets and cellars for the storage of tools should be discouraged.

There is a considerable loss of tools in extra and other large gangs due to allowing them to get scattered, where they are either lost or stolen. This can be largely avoided if the foreman will designate some one in the gang to look after the tools, keeping them picked up daily and put in a safe place.

During the winter months when large numbers of extra men are put on to handle snow and ice, a great many snow shovels and picks are lost, due to leaving them on the work. To reduce this loss to the minimum the foreman should require every man to turn in his tools when the gang is checked up at night.

Foremen should be instructed to see that their men use the tools for the work for which they are intended and not subject them to improper use, such as using a spike maul when a sledge should be used; or using a shovel for a pry, often damaging the tool or material and increasing the cost of the work.

One item of tool expense that is not receiving the attention it should is the quality and character of tools. Sufficient tests should be made and records kept to assure the railroad that the tools they receive from the manufacturers are of such quality that they will prove economical for the price, as there is no more expensive tool than the one that fails after it has been used only a short time.

Each road should investigate its needs and know that the tools it uses are the best type for their particular work

and not continue to use those that are unsuited to their conditions, for with present labor costs it is essential that tools should be of good quality and proper design to promote economical work.

THE CARE OF WATER SERVICE TOOLS

By F. M. Case

Supervisor of Water Service, Chicago & Northwestern, Belle Plaine, Iowa

AS RAILROAD water supply equipment is wide in scope and greatly diversified, its maintenance requires a considerable variety of tools. The nature of water supply work renders tools peculiarly liable to rough usage, loss and theft. As a preponderance of these tools are owned and furnished by the railroad company, those who use them must be held accountable for their loss or ill usage, and responsible for their condition. The importance of proper care and of accessibility of all tools and working appliances should also be impressed upon those whose duties are to use them.

No tools or appliances of efficient types and in usable condition should be discarded until damaged beyond repair or otherwise unfitted for profitable service. After being used a tool should be well cleaned and put in its proper place. At the assembling point or headquarters of maintenance men a conveniently situated building should be provided for use as a repair shop and with facilities for the segregated storage of tools.

Where the work to be done is extensive and entails continuous absence from the home point, a tool car should be furnished, well equipped with a full complement of tools and appliances as required to carry on the work in hand and with well allotted space for the storage and care of tools.

For emergency repairs, each district repairman should have a substantial tool box (not a tool bag) of ample size, stocked with a sufficient variety of tools to make all ordinary and at times extraordinary repairs. In many cases this will enable the repairman to complete the job at one trip and quickly to remedy situations where a required second trip, due to lack of tools, would jeopardize, if not suspend, traffic. Supervisors should see to it that repairmen are supplied with required tools and that they carry a sufficient outfit to insure efficient service.

Obviously it is good policy for the employer to furnish tools of a type and grade wherewith maximum efficiency with minimum expenditure of time and labor may be attained. Men worth keeping will appreciate such tools and may be readily induced to use and care for them properly. To interest the users, the relative merits of different types and classes of tools should be discussed frequently. Such discussions should be initiated and encouraged by supervisors and foremen.

THE DISTRIBUTION SHOULD BE CAREFULLY CHECKED

By J. J. Hess

General Roadmaster, Great Northern, Seattle, Wash.

TOOLS ON the Great Northern are delivered to the gangs by supply cars moving over the line once a month. Requisitions made in advance are scrutinized closely by officers before being passed to the stores department. Tools, except handles, are delivered to the various sections only in exchange for old ones worn out or for tools requiring repairs, the only exception being for tools not previously furnished or tools lost or stolen, for which special requisitions are made by properly designated officers. The tool houses, boxes, etc., are locked with a standard padlock for which roadmasters have a master key.

A standard tool list for sections is prescribed, it being the duty of roadmasters to see that it is not exceeded. Consequently, the latter make it a point to visit tool houses frequently to see that the list is being conformed to, that tools are kept in places provided for them and that they are in good working order. It is not considered good practice or economy for tools to be otherwise. The requirement of an exchange of tools referred to is a good preventive of theft and while quite a loss is experienced at that, yet it is a good check to prevent losses becoming excessive.

It is also a matter of supervision to see that the proper tools are used for the purposes intended, which, of course, further emphasizes the fact that it is false economy not to provide proper tools of the necessary types for the various classes of work and in sufficient quantity. A shovel should not be used to hold up a tie or insert a tie, if a pick, a tong or a bar is furnished. Proper supervision implies that they are used only for the purpose intended.

The improper practice is often so thoroughly established that it is difficult to break it up, but like everything else, by constantly calling the necessity and advantages of it to the attention of all concerned, results will be secured in the end.

SPLIT HEAD RAIL CAUSES DERAILMENT OF PASSENGER TRAIN

A REPORT was issued recently by the Bureau of Safety of the Interstate Commerce Commission calling attention to the dangerous character of split head rail failures, this report being based on an investigation of a derailment on the Chicago Great Western near Wyeth, Mo., on January 3, 1920. The investigation was made by James E. Howard, engineer physicist of the Commission.

The report goes into considerable detail in explaining what a split head rail failure is, pointing out that the split head occurs in the ball of the rail as a vertical interior rupture which eventually extends down to the junction of the head and the web, and that final failure occurs when a complete separation of the two halves of the head take place. The report makes it clear that split heads should not be confused with piped rails, the latter occurring in the lower part of the head and in the web and are not found nearly as frequently as the true split head failures.

The cause of the split head failure is attributed to a distortion of the grain of the steel, bringing about lateral flow of the metal at the running surface of the rail under the effect of the wheel loads in the presence of metal that is structurally unsound. Rails containing split heads are found to have longitudinal streaks which are lines of weakness on the interior of the head. Attention is drawn to the necessity for correction of mill practices to overcome these defects. A particular note of warning is given in the report pointing out the serious nature of this type of rail failure.

There is a popular fallacy entertained that the split-head rails do not constitute a dangerous type of fracture, since at certain stages in their progress of rupture they may be detected in the track. This evidence, however, is presented at a late stage, after the necessary margin in strength in the rail has been practically exhausted, and not prior thereto. An element of danger has arisen when split-head rails are detectable in the track. An economic question is involved in the elimination of the causes of split-head failures, since many rails are removed for this cause which are not otherwise unserviceable. Finally, split-head failures should not be reported as piped rails.

RAISING THE TRACK WILL IMPROVE MAINTENANCE

By W. F. RENCH

SEVERAL YEARS ago an interesting discussion took place within the pages of this journal as to the relative merits of surfacing out of face and spotting low joints. A comparison of conditions found to exist today with those that existed two years ago, on considerable sections of three important railroads in the eastern region, these having been studied with the same opportunity for detailed examination in both cases, convinces the writer that the present deterioration, where it is in evidence, is due to failure to prosecute raising of the track. Indeed, this item of work constitutes the greatest single need in maintenance today, or, lacking the opportunity to effect a raise of the grade, as sometimes is the case where fixed structures prevent, the cleaning of the ballast, to a sufficient depth for drainage, is next in order.

The feature that will at once impress the maintenance officer in walking over a stretch of track is the lack of uniformity in its maintenance. An extremely dirty, poorly drained and evidently centerbound piece of track will alternate with a section unexcelled in this regard. The divergence is also evident in many cases on different parts of the same section, the greater portion of a section sometimes being specially good, while a small part of it is exceedingly bad. This lack of uniformity applies almost entirely to the roadbed condition, and does not ordinarily extend to the maintenance of the ties, which is given due attention because it is concerned with the safety of traffic.

There appears to be no connection at all between the track condition and the personnel of the section maintainers. An increase is undoubtedly noticeable in the relative number of men of foreign birth employed as foremen on each of the roads under consideration; but while this fact in itself presents points of interest if not of concern, to the operating officer, its analysis forms no part of the subject now being discussed. It may be remarked in passing that the problem arising out of the presence of a large proportion of foreigners among the section foremen is now being met by the addition of general foremen specially charged with the duty of organizing the work of these men, the ability of whom on the track is not disputed.

The large amount of dirt found permeating the ballast in the poorer stretches of road removes all chance of adequate drainage. The invariable sequence is a pumping of the joints, which in turn causes deterioration of the line, the final result being a poor riding track, in spite of good rail and ties which are in place practically everywhere. The added disadvantage which results from the presence of dirt in the ballast is the growth of grass and weeds in the track, causing further obstruction to the drainage, besides being unsightly at all times. A dirty track tends to become exceedingly hard, necessitating additional effort and expense for the detailed surfacing which is required at frequent intervals to maintain even a passable grade of line and surface.

With reduced allotments the effort has been put forth in several places to restore the clean condition of the ballast by means of ballast cleaning devices. While these have helped, especially by enabling the cleaning to proceed, even though a force of no more than five men was available, the demands of other work have prevented their employment continuously. While a record of 300 ft. of center ditch cleaned with five men in an eight-hour day has been attained, which is twice that of an equal number of men working with forks, it has not been found possible to maintain this performance in all kinds of roadbed, and the average performance is little greater than by hand methods. Cleaning the ballast alone has met but the single need of improved drainage, while the cumulative roughness of the track has remained to be remedied.

A raise of the track, which at this time need only be a couple of inches, will free the ballast of dirt sufficiently to restore drainage, will improve the surface specially as regards the unfavorable condition of being center bound, and will make the appearance of the road a reassuring one to the traveler. Only a moderate amount of new ballast will be required, which indeed will be no more for a light lift over a considerable portion of the section than for a heavy lift over a limited stretch. The making of heavy lifts, merely for the purpose of obtaining a deeper bed of ballast, well may be postponed until the general surface and drainage conditions have been improved.

The lack of uniformity on the sections probably is due to the difficulty of following out a regular program of work by reason of fluctuations in the earnings. With plenty of material available, and, in fact, already delivered on the ground, it is no unusual occurrence for arbitrary orders to be issued for the suspension of renewals during the latter half of a month or for an entire month. Thus, the renewals, which should generally precede the raising out of face, are held up while detailed surfacing of the track is proceeded with, without any permanent betterment of the track being obtained.

The irregular program thereby created has its effect upon the section labor, which, taken by and large, is now fairly efficient, certainly remarkably so if judged by the standard of two years ago. Even following the reductions in wages put in effect July 1 there is a noticeable absence of the independence and unwillingness which formerly characterized much of the labor on the track. The men recognize that the railroad job, considering specially its steady employment, is probably as good as any today. But even a willing laborer is resentful of being held up in the prosecution of routine work which is under way and progressing smoothly.

It seems to the writer to be in order, if the roads are to get back to passable conditions before winter, to formulate a definite program of work, based particularly upon improving first the inferior stretches so as to effect a degree of uniformity in the maintenance, and to adhere to this program with the utmost tenacity. It is appreciated that a slight increase in the labor allotments may be necessary, since track raising can neither be performed efficiently nor altogether safely without a sufficient force of men. Whether the tamping is done by hand labor or machines are available to expedite the work, the program should be carried out consistently and the necessary ballast be provided for backfilling the track.

The improvement from raising the tracks will be accentuated in cuts. It is probable that no general scheme of deepening the ditches has been prosecuted for several years past. Ditching has been limited practically to that required for passing off the surface drainage. It is well known that good maintenance requires a depth of side ditches that will provide also for the draining of the roadbed. Raising the track in cuts will supply this advantage without the need of cutting back the slopes, which in some cases would require the resodding of the banks. This fact well may be given consideration when determining between the raising of track in a cut or on a fill, when both cannot be done.

Along with whatever improvement is undertaken it is suggested that due attention be given to the item of policing. This feature costs so little relatively, when compared with the results obtained, that the expense well may be incurred, even though maintenance may be severely restricted for the time being.

Ventilating Plant at the Eaton Tunnel of the Baltimore & Ohio.

AN ORGANIZATION FOR TUNNEL MAINTENANCE

The Baltimore & Ohio Concentrates All Such Work on Its Lines in One Department With System Gangs

THE BALTIMORE & OHIO has on its lines a total of 150 tunnels with an aggregate length of approximately 23 miles. With such a number and mileage, it is not surprising that the road has developed a separate and distinct organization or tunnel bureau to take charge of their proper maintenance. In addition to maintaining a separate force of workmen the road has assigned certain equipment exclusively to this particular class of work, while the tunnel forces are also permitted to draw on the general maintenance of way equipment whenever necessary.

These 150 tunnels of the Baltimore & Ohio vary in length from a minimum of 100 ft. up to a maximum of 7,400 ft. Only four divisions on the road are entirely free from tunnels, while on the remainder the number varies up a maximum of 24 on the Monongah division. On the Parkersburgh branch of the Monongah division there are a total of 23 tunnels in a stretch of 98 miles. On the Belt line in the city of Baltimore there are nine tunnels alone, one of which being the longest on the road. This tunnel, 7,400 ft. in length, connects the Mount Royal station of this road with its Camden station, located on opposite sides of the main business center of the city. This tunnel is double track and passes under the most congested part of the city.

An Organization for the Entire System

The organization used in tunnel work is comparatively simple, consisting of a number of field gangs of from 12 to 25 men, each in charge of a skilled foreman and an assistant foreman, who work over the entire system. These foremen report to and receive their instructions from an inspector of tunnels, who maintains his headquarters at Baltimore, Md. He, in turn, reports to the assistant to the chief engineer maintenance, who, as head of this sub-department or tunnel organization, reports periodically to the chief engineer maintenance on expenditures for prospective work, on the results accomplished, etc. Each foreman keeps a record of the work upon which he is engaged, reporting regularly to the inspector of tunnels, who correlates the information so received into reports to the assistant to the chief engineer maintenance. These reports are roughly classified into two forms, the first of which is a progress report for the month, showing in detail the amount of work which has been accomplished on each undertaking, the amount of material used, the cost and an outline of the work to be done in the next month, or, if the work in any particular tunnel can be completed in less than a month, an outline of the work necessary to complete it. The second is a completion report, which is made shortly after a piece of tunnel work has been completed. This report shows in detail the location, the amount of material received and used, the labor required, the total amount of work done and the cost.

All work, in so far as it is possible, is carefully scheduled as a part of the annual budget of the maintenance of way department, although shown on that budget as separate expenditures for tunnel maintenance. The tunnel maintenance budget is prepared after a careful investigation of each tunnel on the system. Late in the fall the inspector of tunnels makes a trip over the lines and inspects personally every foot of each tunnel. From this inspection and the data that he has obtained relative to their condition he prepares a preliminary budget for the ensuing year. In this preliminary budget each tunnel is dealt with separately and the material and labor costs are shown in detail. After this has been rechecked against the field notes it is submitted to the assistant to the chief engineer maintenance.

This officer in company with the inspector of tunnels then makes a personal inspection of each tunnel and decides in the field the relative importance of each piece of work. The preliminary budget is next corrected to correspond with the decisions thus made and the final budget made and submitted to the chief engineer maintenance. After the authority for expenditure has been made the work is carried out in the order of its relative importance as shown in the budget.

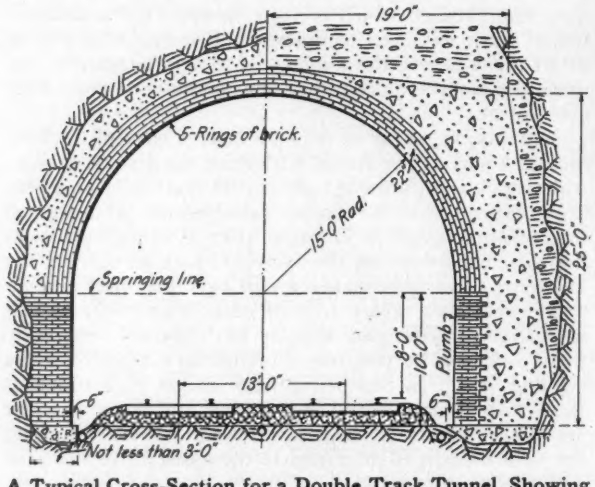
All Equipment Follows General Pooling Plan

A certain amount of equipment is assigned permanently to each gang. As they are floating forces they have their own bunk cars, a kitchen car, a mess car and one or

more tool and material cars. Generally, each layout includes a box car, a gondola or some other type of open-top car, a large capacity push-car or trailer and a hand car. In many cases the equipment includes a motor car.

Handling the Material on the Sand Patch Tunnel in the Allegheny Mountains

Such other equipment as is not used regularly on each piece of work is pooled, the different tunnel gangs drawing on the pool for various pieces, as they are found necessary. In this class of equipment are included cement guns, hoisting engines, steam and gasoline-driven pumps, pulsometers, grout pumps, motor cars, etc. Other classes of equipment not regularly used by the tunnel



A Typical Cross-Section for a Double Track Tunnel, Showing Half Section for Normal Conditions and Half Section Illustrative of the Method of Building in Case of Slides

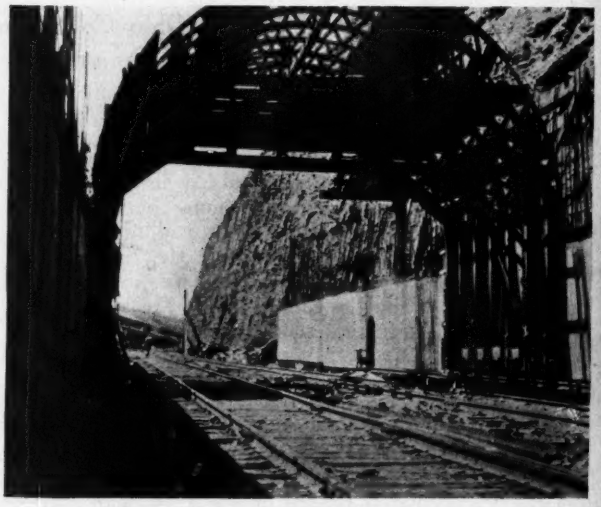
organization, but in more or less regular use by the maintenance of way department is drawn as needed. In this class are included concrete mixers, derricks, locomotive cranes and other miscellaneous heavy equipment.

In order to facilitate the distribution of all equipment regular statements are prepared on each division and forwarded to the main office at Baltimore, showing the location of each piece, its condition, its capacity and whether in use or not. Thus the officer in charge of tunnel work can quickly arrange for and collect the equipment necessary for any particular piece of work. All materials for the work are likewise handled through the main office, their purchase and delivery being under the direction of the head of the tunnel organization.

ALTERATIONS AND CHANGES PERFORMED UNDER TRAFFIC

Covering a period of over 26 years the Baltimore & Ohio has made alterations and extensions, exclusive of normal maintenance and repairs, on a total length of tunnels approximating 9 miles of the 23 miles of tunnel construction. This work has entailed a large amount of reconstruction, necessary to obtain increased clearances and in many instances in changing from single to double track. With but two exceptions all tunnel work has been carried on under traffic and the tunnel organization of this road has not yet had a personal injury among its employees that has cost the road any money. In general the alterations have, in addition to securing increased clearances where necessary, consisted of relining the tunnels with brick, this material having been found to be one of the most satisfactory for the purpose.

In working under traffic a complete telephone system is installed with phones at each portal and at the location of the work. The foreman remains at or close to the telephone in the tunnel and receives all messages regard-



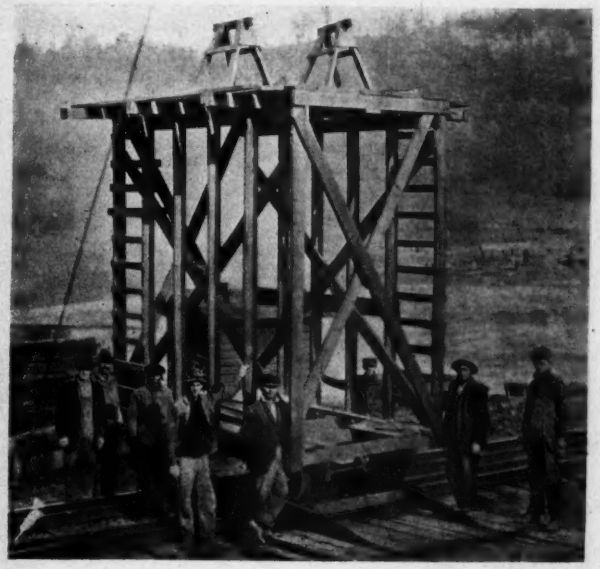
An Interesting Type of Centering as Used on the Baltimore & Ohio

ing approaching trains. He is thus given sufficient time to take ample precautions for the safety of his men. The work of relining or for that matter any work on the tunnel roof is carried on from platforms and in some cases from movable scaffolds. Usually hinged platforms are used which can be dropped to clear any passing trains. These platforms are about two feet wide and run for varying lengths along the wall of the tunnel. They are supported by being hinged to a timber bolted to the side wall and held up in working position by brackets fastened to the wall and also pivoted to swing clear of trains. Where the entire roof is to be worked over frame work is installed on each wall and forms or centers laid across from one side to the other. In many cases a scaffold is mounted upon the trucks of a heavy trailer. This is pulled in and out of the tunnel as needed, by means of a motor car, which is also used for transporting material in and out as needed.

THE USE OF CONCRETE IN TUNNEL REPAIRS

While the greater proportion of the lining of reconstructed or enlarged tunnels has been of brick, concrete

has been used to good advantage in numerous instances. This is especially true where fires or other conditions have destroyed parts of the existing lining or where the lining has deteriorated so much as to be unserviceable or unsafe. Where it is not desirable to rebuild such tunnels because of prospective changes in design or size they are repaired with gunite, using a cement gun. In order to secure uniformly high grade work this equipment is assigned to a regular operator, who maintains and directs its use as called for. In many cases it has been found possible to prolong the life of an old tunnel lining by grouting in behind it. In this work the grout pumps are usually placed in the clear and the grouting pumped through pipes driven through the tunnel walls. Where it is possible and economical the condition is reversed and pipes are driven in from the outside. While it has been stated that the tunnel organization conducts its work independently of the other branches of the maintenance of way department there is a partial exception to the rule here, as all grouting, whether in tunnel work or in bridge and building work is performed by the workmen in the tunnel organization.



One of the Scaffold Cars Regularly Used in Tunnel Work

Whenever it is necessary to completely reline a tunnel or where it is necessary to rebuild it because of limiting clearances the new work is made to conform to Baltimore & Ohio standards. These standards call for a total width of 30 ft. between side walls of a double track tunnel and 18 ft. for single track and clearances of 23 ft. and 21 ft., respectively. Where brick is employed, five rings are used in the double track arches and four in the single track, backed in each case by concrete. Elevation markers are set in the side walls, indicating the maximum height to which the tracks may be raised throughout the length of the tunnel. Safety niches are constructed in the sidewalls 100 ft. apart and staggered. Drainage is provided by means of two lines of pipes in most installations and by three lines where conditions are such as to render this necessary.

Safety Results.—The Safety Department of the Missouri Pacific, awarded first place in its "Safety First League" to the shops at De Soto, Mo., for the month of May. During this period the 382 employees at the De Soto shops worked without an injury of any kind.

WATCH THE WORK TRAIN RESULTS

By Charles Weiss

ONE of the largest as well as one of the most loosely handled items of maintenance work is the operation of work trains. The overhead expense of crew and equipment is so great, and the interference with revenue trains so frequent, that a work train should be managed with the most careful forethought. When it it is recalled that only a fraction of the time paid for is actually utilized as desired due to road delays, it becomes apparent that every minute counts. On a busy railroad it is often found that each minute of work performed costs as high as one dollar. This makes it imperative to eliminate all unnecessary moves and to develop an efficient work train organization.

A supervisor or roadmaster should be guided at all times by the two following principles in laying out his program and issuing work train orders, (1) to confine the train to as small a radius of operations as possible, to do the day's work, and (2) to use the work train only for such purposes as cannot be met otherwise.

To carry out these principles it is, of course, first necessary to maintain some kind of handy file of all work to be done with a train. At the beginning of the week, then, a tentative schedule is made out for the entire week. This will not necessarily include all small details, but should be a skeleton outline, made for the purpose primarily of determining what part of the division should be covered each day, and to prevent the train traveling over the same territory more often than necessary. The ideal condition and one which will rarely if ever be realized, is to have the work train spend one day on each sixth part of the division and to reduce its mileage to a minimum. The greater the mileage made the more time is lost in moving, and on side tracks waiting for other trains. Make it possible to work without frequent train orders and if convenient keep the train in one block so that all the work can be done without any orders at all by having a flagman in each direction.

The fulfillment of the second principle means making the fullest use of local freight trains. Small shipments of tools or supplies should be made in this manner. Cars should not be picked up and set off by work trains excepting in cases of emergency. Ship them by freight. Material to be picked up by the work train should be piled conveniently for loading and in the case of scrap should be gathered at convenient points like tool houses and mile posts, by section men. Motor cars with trailer trucks or even hand trucks should be used to assemble such material.

The most careful planning in accordance with the above will not be productive of results, unless similar care has been taken in the selection and training of the work train personnel. In general, the men are not selected for their expertness in details of track work, but rather for their strength and energy. They should be men who are willing to work with might and main when the time comes and who realize that they will be given sufficient rest or other privileges to encourage them to use all their resources every second of the time when they are off the train. Oftentimes it is only possible to get out on the road with trains for a few minutes at a time, and that is why the workmen must work at a more strenuous pace than men who work steadily all day like section men. If a spirit of team work is developed, much has already been accomplished.

The foreman, being the captain, is the most important member of the team and is chosen for his ability to lead others. The desirable qualities of such a leader usually specified on paper are not entirely attainable by any one

lower than a ten-thousand-dollar-man, but this quality of being able to organize his gang and get their co-operation is most essential. He must train his men to get off the train as soon as it stops and to pitch right in. He must also train himself to be able to keep the men busy whenever the train does stop, for oftentimes it will be blocked or held where no regular work is scheduled. If he is equal to his job, he will find scrap to pick up, ditching to do, right of way to be cleaned or mowed and a thousand other useful tasks that will partly atone for the time lost. He should have his men trained for particular tasks, without further instruction from him. Thus two or more men will be assigned to picking up scrap every time the train stops for other work, providing they are not necessary at the time. Another will be used to keep count of material loaded or unloaded. Still another man will have the task of taking care of the tools, keeping them oiled and reporting shortages. One man will take care of the fire in the riding coach, the drinking water and all the cleaning up. These and similar tasks can all be performed without the loss of any man from the gang, and will give each man an added responsibility that will increase his interest and enthusiasm in the work.

To further increase the efficiency of the work train, the supervisor should spend more time with it. Too frequently his supervision of it ends with the writing of the work train orders, resulting in a gradual decrease of effort. He should frequently stay with the train for a large part of the day and himself handle the job (through the foreman of course). His mere presence will result in more work being accomplished than otherwise, and he should utilize this fact by comparing with the foreman this result with the work done on other days. Such a check will act as a spur to greater effort. Another check is to at least occasionally be on hand at the beginning of the working day, to observe how much time is lost in getting started. The foreman should keep a record of all delays on the road, and these can be utilized to get more co-operation from the operating department.

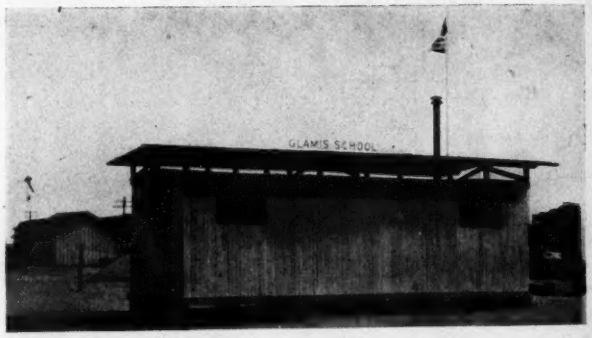
The foreman's responsibility should not, however, end with reporting delays, for very often the conductor is to blame for not making an earnest attempt "to get the track" from the dispatcher. It is immaterial to him how little is accomplished, especially while his pay runs on, and besides, delays may mean more overtime. For this reason the foreman should keep after the conductor, and try to get out on the road, even if only for a few minutes. The two should be encouraged to co-operate, but by keeping a check on each other they will automatically be driven to greater effort. When a good conductor is found an attempt should be made to hold him for the work train, for it also takes some time to train conductors to realize the peculiarities of a work train as distinguished from an ordinary train.

The matter of equipment is also important. Whatever there is should be kept in good condition, properly lubricated and maintained. All labor-saving devices like dump cars, rail loaders and flame cutting outfits should be utilized to the fullest extent. The tool car should be completed and, besides track tools, should include cables, ropes, blocks, rerailing frogs and other equipment for wrecking purposes. There should be calcium lights for night work and a car of emergency supplies, including rail, ties, spikes, splices and all track appliances. These may save the necessity of calling out wrecking or other trains quite often. The riding coach should be kept clean and sanitary. It should include a commissary for use at bad wrecks when away from any place where food can be obtained. In the winter time, at least, the means for warming food will be found to add greatly to the efficiency of the men.

Poor track facilities for a work train are the cause of considerable delay in getting started in the morning and in getting in at night, as well as in shifting the cars. There should be at least two tracks and preferably three, one or part of one serving as a storage track for equipment not often used. There should also be a wharf along one of the tracks, along which cars can be placed for loading or unloading. If property is available a number of spurs can be run out, along which all the material can be placed.

A NOVEL USE FOR A CAR BODY

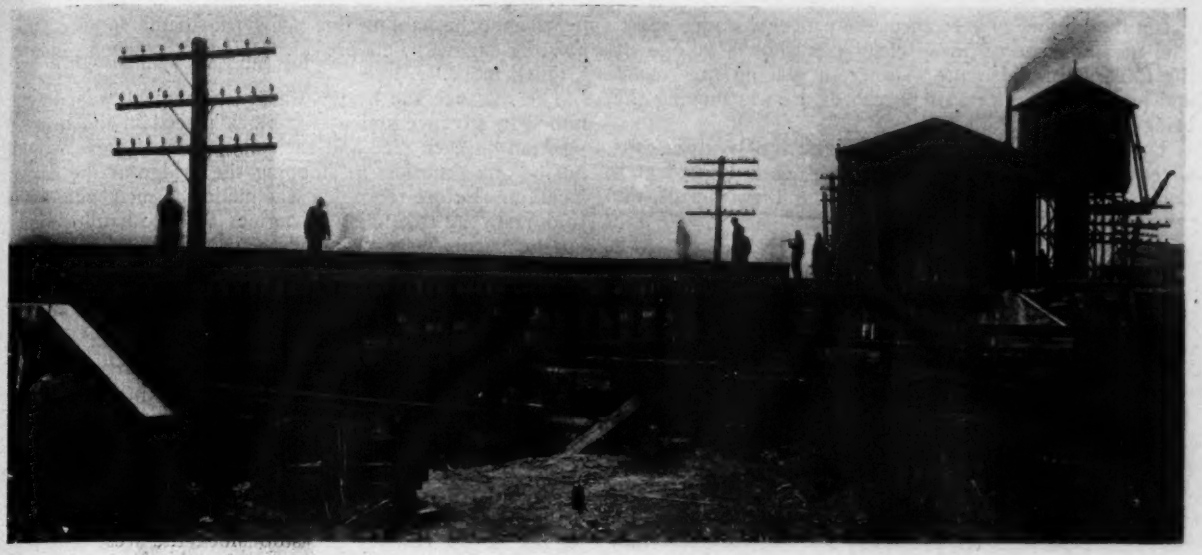
NOT the least interesting observation to be made of the present period of railroading is the close attention which many roads are giving to the interests of the employee as well as those of the public. Originating largely in the recognition of the importance of a contented organization as well as a well-served public as an element of efficient railway operation, it is now common to find workshops quite as attractive for workmen as depots are made for passengers and not at all uncommon for the casual observer to find railroads associated with activities that appear at first glance to have little or no bearing on the subject of transportation. The extent to which the progressive road occasionally goes in this respect is well illustrated in the following practice on the Southern Pacific, a practice which is interesting also in presenting a new possibility for the condemned car body.



The School House at Glamis

Glamis and Ogilby are two stations on the main line of the Southern Pacific west of Yuma, Ariz. Both stations are situated in the desert miles from any town and particularly from public schools to which the employees could send their children. At each station three operators, one signal maintainer and two section gangs are employed. Owing to the important bearing which the question of schooling had upon the willingness of the more desirable class of employees to remain at such stations and the number of prospective students not being sufficient at any one station to warrant the establishing a separate schools at these stations, the Southern Pacific took it upon itself to provide the desired facilities. To this end a condemned car body was provided at each station and an agreement entered into with the school district under which the railroad pays one-half of the teacher's salary. The car body at each point is properly fitted with a sun roof, windows, doors and school furniture and affords an entirely satisfactory solution of the problem. During the winter school session these schools averaged 14 pupils.

We are indebted for this information to G. W. Carrigan, division engineer on the Southern Pacific at Los Angeles, Cal., on whose division these schools were built.



Side View Showing New Bridge in Place, an Accomplishment Which Was Effected in 45 Minutes.

REMARKABLE SPEED SHOWN IN BRIDGE RENEWING

Three Span, Double-Track Structure Changed and Made Ready for Traffic in Forty-Five Minutes

BY S. C. TANNER

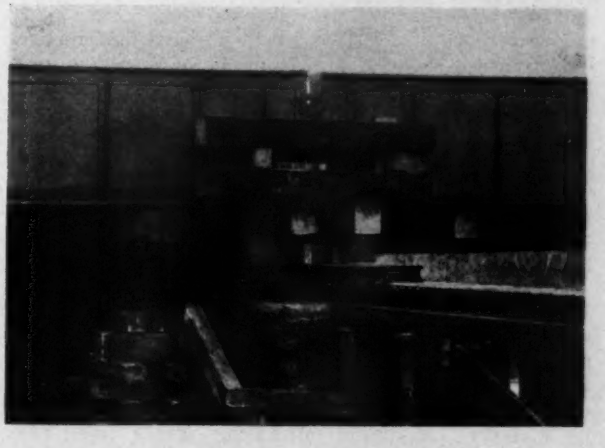
Superintendent of Maintenance of Way Shops, Baltimore & Ohio, Martinsburg, W. Va.

IN THE INSTALLATION of railroad bridges, the most important feature of the operation is to make the change from the old bridge to the new without interruption to traffic. To do this requires continual study of the local conditions to insure ample preparedness and at the same time to avoid overpreparedness where traffic is light. In performing such work there are many methods of procedure which may all be good, but the character of the structure and volume of traffic should govern the method employed.

On January 8, 1921, the through girders in bridge No. 31-D at College Park, Md., between Washington, D. C., and Baltimore, on the Washington branch of the Baltimore & Ohio, were replaced with deck plate girder spans. To do this while maintaining the normal clearance under the bridge and using the same masonry, it was necessary to raise the track 2½ ft. at the bridge and make a runoff of about one-half mile in each direction. When this was done the new girders were placed on temporary trestle bents alongside of the old girders, as shown in one of the accompanying illustrations. After painting the girders and placing ties, guard rails and track rails on the new girders, preparations were made to move the old girders out and the new ones into place at one operation.

These preparations constituted the most important feature of the entire work, owing to the fact that at this location the greatest length of time between scheduled trains is from 10:43 a. m. to 11:43 a. m., or just one hour, and that the traffic consists of high speed express trains with many extra and local freight trains to increase the congestion. The total weight to be moved was about 700,000 lb. The bridge is a double-track structure and consists of three spans in each track, making six old spans to move out and six new ones to move in, or a total of 12 spans of girders to move at one operation. To do this the roller method was employed, nests of rollers in sufficient number to permit the necessary movement of 25 ft. 1 in. being placed on the piers and abutments.

Owing to the bridge being three spans long it was necessary, before moving, to clamp the girders together in such a way as to make them rigid against buckling

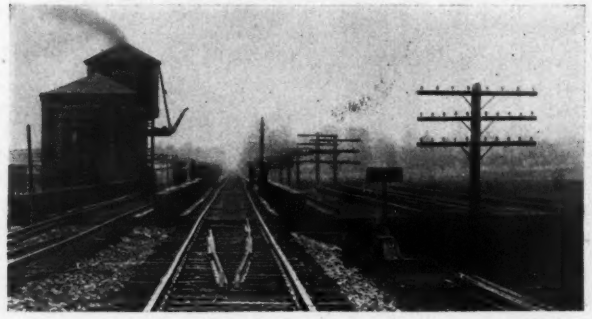


Detail of Girder Clamps and Roller Way

or moving out of line during the operation. This was accomplished by placing two 12-in. by 12-in. by 10-ft. timbers on each side of each joint between girders and notching them over the stiffeners in the girders to prevent them from pulling endwise or slipping. The 12-in. by 12-in. by 10-ft. timbers thus placed were clamped together with ⅞-in. bolts and wooden struts placed be-

tween the girders to keep them the proper distance apart. The arrangement of these clamps is shown in one of the illustrations, also the manner of placing the rollers and bents and the kind of purchases used in moving the bridges.

The power used to pull the bridges into position consisted of two 35-hp. hoisting engines, each located at a point 100 ft. out from the bridge and two-thirds the length of the end girder from the end of the bridge, the arrangement being such as to balance the load between the two engines. Manila rope of 1½ in. diameter with two five-sheave blocks were used for each of the two purchases, the hauling line being run to the spool of the hoisting engine. This provided sufficient power to insure a quick move.



Bridge Ready to Move. Waiting for Last Train to Pass

The distance the bridge was to be moved was determined in advance and a stop block placed in the proper position on each pier and each abutment so there would not be any time lost in stopping the bridge at the exact location. Before the move was made the men who were to operate the two hoisting engines and the hauling lines on the spools were organized and trained to run their engines as close to the same speed as possible and to understand fully the signals to be given by the man in charge of the work, thus avoiding the possibility of moving one end of the structure faster than the other. In addition to this a painted board laid off in figures from 0 to 25 ft. was placed at each end of the bridge so that the progress of the movement could be watched by the man in charge of the signals and any tendency of one end of the bridge to gain on the other and foul between backwalls avoided.

This plan worked out so well that when the east end of the bridge reached the stop block the west end had but 1½ in. further to go, and the 12 spans of girders were moved the 25 ft. 1 in. to the new location in 3 min. and 30 sec. The track forces were also organized for their work and as a result, in 45 min. after the last train had passed, the track was again connected up and ready for all trains on both tracks in each directions without any delay to traffic.

The Purchase, Inspection and Distribution of Cross Ties*

PRIOR to the return of the railroads to their owners on March 1, 1920, some of them had started toward normalcy in the procurement of their cross-ties by making tentative arrangements along the lines of their former methods of purchase. In not a few instances the practice established during federal control of dealing direct with any producers of ties along a railroad was continued where it had not been in vogue before 1918. All railroads which adopted the sight-draft method of paying for ties during 1918-1919 continued the practice. Most railroads which learned during the war that their local production could be stimulated persisted in keeping in touch with the supply along their lines. Some railroads which got the habit of co-operation while the government insisted on it, found it possible to acquire ties of the groups they did not desire and to transfer them, together with their surplus production, to roads which used such ties, and which in return did not compete with the local road for any ties produced along its lines.

Cross-tie buying became normal soon after March 1, 1920, and the strenuous competition which developed in certain fields during the summer resulted in exorbitant prices. It is now seen, even by the producers who profited thereby, that the prices paid were the result of ruinous competition, were not justified, and were not good for the tie industry. A central purchasing agency could prevent a repetition of this vicious competition for ties among railroads, but the committee regards such an agency as impracticable. It believes that the sentiment against unwise competition is developing steadily and that 1920 saw less of it than might have been expected from past performances under similar conditions of supply and demand.

As practices of general application which have been tried under conditions of control and of freedom, the committee recommends the adoption of the following:

(1) That each railroad adopt all means compatible with its conditions and organization to procure along its own lines as large a portion of its tie requirements as possible.

(2) That each railroad adopt a method of paying cash for its ties, as a means for maintaining production at a maximum.

(3) That each railroad along which ties in excess of its own requirements are produced endeavor to make arrangements with railroads needing such ties for their sale and shipment under conditions which will be mutually satisfactory.

(4) That all railroads purchase cross-ties under the uniform requirements of the standard specification for cross-ties of the American Railway Engineering Association.

The preservative treatment of wood to prevent decay yearly becomes a more important factor in the economical maintenance of railroads. This is especialy true in cross-ties. From 100,000 treated in 1885 the total rose to 40,000,000 during 1920. As the forest resources of the United States are depleted, with consequent mounting costs for forest products, more wood will have to be treated. This not only reduces the annual costs of maintenance during longer life of the treated material, but treatment makes available woods not otherwise fit for use, and generally opens up sources of local supply for railroads of which they otherwise could not avail themselves. In the expenditure of money for the preservative treatment of wood care should be taken to see that the results desired are obtained. This is possible only by strict adherence to the requirements which have been worked out after years of experience with standard processes. It is

*Abstracted from a report presented before the annual meeting of the Purchases and Stores Section of the American Railroad Association at Chicago on June 10.

recommended by the committee that all railroads use only the standard specifications for the preservative treatment of wood adopted by the American Railway Engineering Association.

During 1920 there was less than the usual variation in the inspection of cross-ties by competing railroads. This was undoubtedly the result of the marked change in the manufacture of ties which resulted from nearly two years of adherence to a uniform standard applied everywhere quite consistently. The full benefits of a standard specification are not to be had if the specification ceases to be a standard through lack of uniformity in the application of its requirements by inspectors.

The chapter on "inspection" in the standard specification for cross-ties quoted under the heading of "Purchase" provides the definitions and rules which largely constituted the so-called "judgment" of inspectors, and by being available to both producer and consumer, and part of the agreement under which ties are purchased, removes all debate from disputes over ties and reduces decisions on them to facts about their size and condition. It is recommended by the committee that no railroad omit the inspection chapter in its issue of the standard specification for cross-ties.

The inspection of the preservative treatment of wood requires knowledge of seasoning, storage, chemicals, mathematics and machinery not ordinarily possessed by the inspector of raw ties and lumber. An outline of what is required of an inspector of wood-preserving is to be seen in the 1921 proceedings of the American Wood-Preservers' Association. It is recommended by the committee that only competent inspectors of wood preserving be used to determine the fitness of ties before and after preservative treatment.

This committee is aware of a well-defined conviction in the minds of some members that only by American Railway Association control of the inspection of forest products purchased by railroads can the disadvantages to all concerned of the present competitive system be avoided. Undoubtedly a central supervision of inspection would result in greater uniformity in practice, in lower costs through fuller use of fewer inspectors, and in more prompt service for the shippers, and the committee can advance no valid argument against the creation of a Bureau of Forest Products in the American Railway Association, charged with the supervision of inspection and the dissemination of information of value to members in connection with the purchase and storage of forest products, but the committee feels that it is unfair to railroads generally to assume that practical uniformity in cross-tie procurement cannot be had prior to a trial under the new conditions brought about through the existence of a standard specification worked out and adopted by an independent railroad association and agreed to and adopted in all essential respects by the producers' association. The report was signed by J. H. Waterman (C. B. & Q.), chairman; John Foley (Pennsylvania), G. H. Jenkins (G. T.) and A. H. Young (S. A. L.).

In presenting the report Mr. Waterman stated that M. J. Collins, purchasing agent of the Santa Fe and a member of the committee, was unwilling to sign the report for the reason that while he felt that the report undoubtedly would be of great benefit to roads which had not already developed their own specifications and methods of handling cross ties, and while there were many things in it to which he could subscribe, taking the report as a whole he did not ee where the Santa Fe would be particularly benefited by changing from its own specifications and he could not therefore consistently attach his signature to the report.

The report was accepted for publication on a motion carefully prepared to avoid conveying the impression that the Purchases and Stores Section approved it.

A RIGID DECK TRACK SCALE

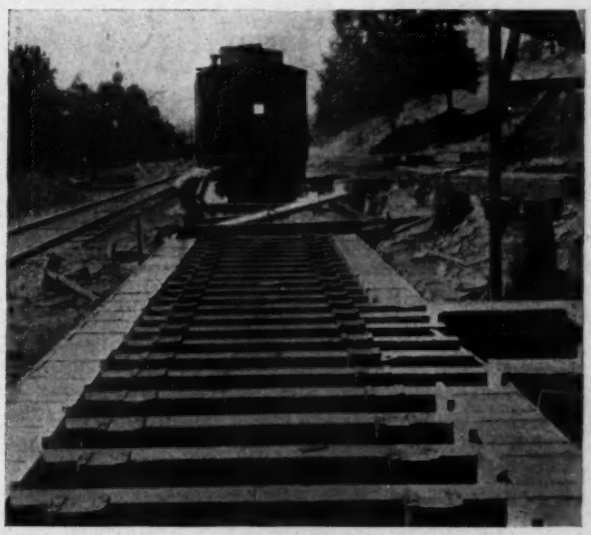
By C. H. Mann,

Superintendent of Scales, Southern Railway, Washington, D. C.

THE sketch and photograph indicate a method ot converting an old style platform scale into a rigid deck scale installation. The design is such that it accomplishes the removal of the dead rail piers and stands from the scale pit. This means maximum accessibiilty for inspection and repairs, which is a very desirable and important factor, greatly appreciated by the practical scale man.

As will be noted, the scheme is to carry the dead rail on transverse timber stringers from wall to wall. Sound 8-in. by 12-in. timbers are used, spaced about 22 in. centers, the span from wall to wall being not more than 7 ft. 6 in. The stringers should have ample bearing on the side walls, and it is best to pour concrete between the stringers to keep them properly spaced. This construction is adequate for engines with axle loads not exceeding 45,000 lb., unit stress in bending being about 1,400 lb. per sq. in. for the timber.

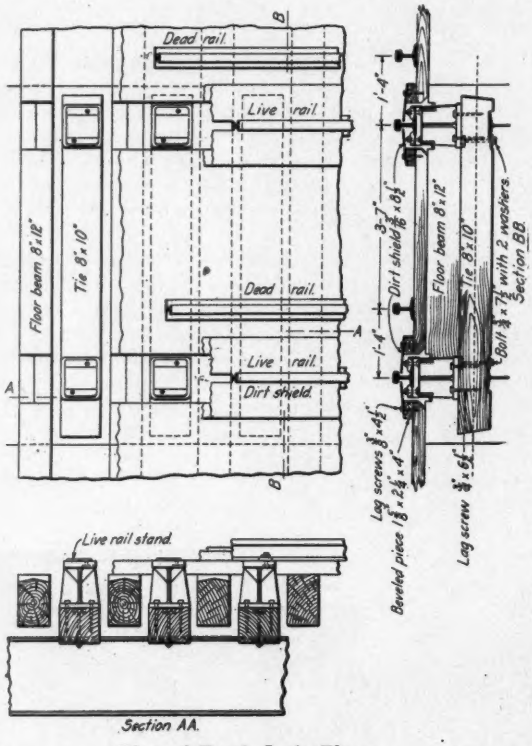
The live scale rail is supported on 11-in. cast-iron



Top View of Track Scale Floor

stands between the dead rail stringers, the stands being in turn supported by 6-in. by 8-in. or 6-in. by 10-in. ties resting on the weigh-bridge girders. The photograph shows this very clearly. The cast-iron stands and malleable rail clips for fastening the rails thereto are standard designs made by a scale manufacturer, and the material can readily be purchased. We have, however, used this material in quantities, and therefore have our own pattern and cast the stands in our foundry. The sketch shows the live ties anchored to the weigh-bridge girders by heavy bolts; it is necessary to anchor only a few of the ties to the girders at intervals, and the remaining ties are held in position by tying all together by spiking 2-in. by 4-in. pieces at the ends on the lower side. This is cheaper than drilling through the girder for each tie. Another method of anchoring the ties is by fastening them to 2½-in. by 2½-in. angles, which are bolted or riveted at intervals on the top flanges of the girders.

The dirt shield or rain guard is simple and needs no explanation, except that it is desirable to use some standard short length of sheet metal, say 6 ft., in order to facilitate repairs in case of damage by derailment. The platform should be made of 3-in. material, either ship-lap or grooved and splined. The beveled pieces supporting the



Plan of Track Scale Floor

dirt shields should preferably be creosoted, as they are more susceptible to decay than the decking.

The cost of this construction is practically the same as for the live deck installations. The maintenance cost is less because the life of the pivots and bearings of the mechanism is prolonged, and the scale pit need not be cleaned so frequently. It is the writer's opinion that this rigid deck scheme is in most cases a better installation and better design than the well-known live deck or vibratory platform. The conversion from live deck to dead deck is not recommended as standard practice, and this plan has only been used as being next best to purchasing and installing modern scales.

TENTATIVE VALUATIONS ISSUED

The Interstate Commission, Division of Valuation, has issued the following figures as representing its tentative values of the respective railroad properties on June 30 of the year recorded:

Central of Georgia	1915	$79,083,523
Tonopah & Tidewater	1915	2,658,128
Bowden	1915	110,383
Georgia, Southern & Florida	1915	9,860,191
Georgia Northern	1915	877,868
Death Valley	1915	357,546
Dover & Southbound	1914	170,000
Carolina	1914	169,680
Hampton & Branchville	1915	198,124
Arizona Southern	1915	332,288
New Mexico Midland	1916	140,265
Sylvania Central	1915	150,882
Texas Midland	1914	3,096,851
New Orleans, Texas & Mexico	1914	7,495,969
Elgin, Joliet & Eastern	1914	39,049,162
Wrightsville & Tennille	1915	1,597,924
Toodle Valley	1915	229,494
Alabama Central Railway	1915	78,095
St. John & Ophir	1915	123,951
Missouri Southern	1914	920,093
Ray & Gila Valley	1915	627,593
Quincy Western	1915	62,213
Norfolk Southern	1914	24,663,840
Farmers' Grain & Shipping Co	1914	742,822
Brandon, Devil's Lake & Southern	1914	170,000
Mississippi Railroad	1916	576,632
Cape Girardeau & Northern	1914	1,257,716
Potomac, Fredericksburg & Piedmont	1916	561,234
Evansville & Indianapolis	1915	2,250,291
Santa Fe, Raton & Eastern	1916	226,227
Savannah & Northwestern	1915	1,817,271
Northern Dakota	1915	180,468
Talbotton	1915	78,957
Joplin Union Depot	1914	586,708
Cimarron & Northwestern	1916	226,810
St. Francois County	1914	190,190
Mississippi River & Bonne Terre	1914	3,551,685
Hawkinsville & Florida Southern	1915	895,226
Alabama Northern	1914	92,400
Central Railway of Arkansas	1916	201,924
Kinston-Carolina	1914	160,841
Flint River & Northeastern	1915	236,755
Carolina & Yadkin River	1915	766,538
Rome & Northern	1915	283,425
Greene County	1915	152,977
Tampa & Jacksonville	1915	500,000
Mississippi Eastern	1915	227,229
Macon & Birmingham	1915	1,646,967
Albany Passenger Terminal	1915	138,901
Louisville & Wadley	1915	145,201
Bristol	1917	108,600
Kennebec Central	1916	70,700
Bullfrog & Goldfield	1915	1,463,276
Washington, Potomac & Chesapeake	1916	853,750
Fellsmere	1916	110,000
Goldsboro Union Station	1914	145,000
Hardwick & Woodbury	1916	237,906
Monson	1916	77,113
Smoky Mountain	1915	143,794
Norfolk Terminal	1915	1,007,387
Spokane and British Columbia	1915	722,423
Western Pacific	1914	66,730,011
Wood River Branch	1915	115,537
Riverside, Rialto & Pacific	1916	311,488
San Joaquin & Eastern	1916	1,148,000
Central of Oregon	1916	114,450
Grand Canyon	1916	1,359,398
Sumpter Valley	1916	1,829,745
Woodstock	1917	489,213
Minneapolis & Rainy River	1915	1,250,000
Delta Southern	1915	675,346
Toledo, St. Louis & Western	1916	17,282,997
Ann Arbor	1915	11,127,277
Chicago, Milwaukee & Gary	1915	2,889,974
Trinity & Brazos Valley	1916	9,564,566
Lithonia & Arabia	1916	51,858
Milstead	1916	31,924
Blaney & Southern	1916	56,000
Sunset	1916	1,468,226
St. Louis Southwestern & Texas	1916	26,029,939
Lithonia & Arabia	1916	51,858
Milstead	1916	31,924
Blaney & Southern	1916	56,000
Sunset	1916	1,468,226
Timpson & Henderson	1917	392,643
Gulf Texas & Western	1917	1,667,771
White River	1917	392,223
South Manchester	1916	184,425
Montana Western	1915	186,500
Peoria Railway Terminal	1916	1,126.355
Mount Hood	1916	507,463
Gideon & North Island	1917	130,906
Garden City Western	1916	192,099
Washington & Choctaw	1915	147,685
Sardis & Delta	1916	116,000

CAR LOADINGS.—The car loading for the week ending July 16 amounted to 776,252. According to this report the car surplus is now less than 270,000, where it was over 507,000 less than six weeks ago.

PRACTICAL HINTS FOR HANDLING EXPLOSIVES

The Causes of Misfires in Using Dynamite and Powder and Rules of Practice to Avoid Them

THE MAINTENANCE or construction officer who is responsible for the use of explosives in connection with his work, if he is wise, will always endeavor to secure the services of one who is experienced and skilled in such work. However, even if this work can be delegated to some one who is thoroughly familiar with it, it is to the interest of safety that the officer responsible have a fair working knowledge of explosives and their use since this will enable him to judge of the ability and responsibility of the man he employs to do the work and will enable him to make sure that it is being done with a due regard for safety. For this reason we believe that many maintenance and construction officers will find much of value to them in the information given below on the causes of misfires in the use of explosives and the remedies or proper practice outlined to overcome such difficulties, this information having been taken from Du Pont's Magazine.

FAILURE OF FUSE

The fuse may crack and water may penetrate into the powder. This is caused by uncoiling the fuse while cold.

Warm fuse at temperature of 70 deg. to 80 deg. F. for 8 hr. before it is uncoiled.

The fuse may fail to burn through in holes that are dry. Oil, such as gasoline or kerosene, may have come in contact with fuse.

Keep the fuse away from any light or heavy oils in transportation and storage. Do not use grease for waterproofing the fuse, if anything better is available; most greases contain light oils. Do not use paint as a waterproofing material if it contains a light oil drier.

The fuse may not have been lighted.

Be sure that each fuse is really burning before lighting next. Use lead spitter or other sure means of ignition in wet work.

The fuse may not burn through at the end inserted in the cap.

Cut the fuse off clear across with a sharp, clean blade

Be sure to cut one-half inch off old ends, square across, with a sharp, clean blade.

The waterproofing in the fuse may collect on the knife blade and seal the end of the powder train so it will melt on the fulminate in the cap and blacken it without igniting it.

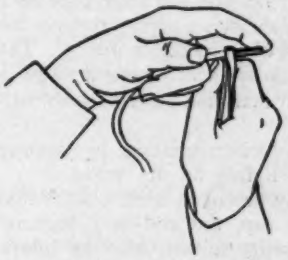
Be sure that the blade is clean and sharp when cutting the fuse. Clean the blade as often as necessary.

Water may be forced through the waterproofing by excess pressure in tamping and later cause the powder train to stop burning.

In holes full of water, especially in shafts, tamp carefully to prevent the development of too much pressure. Use an approved sealing compound for waterproofing, and fire by electricity.

The powder train may be pinched with a knife-edge cap crimper so that it fails to burn through.

Use the late improved type of cap crimper. This makes a wide crimp and there is no possibility of crimping a cap too tight. In fact, it should be crimped as tight as possible.



Crimping the cap to the fuse

The fuse may be injured by using tamping material which is too coarse and sharp, or by rough or careless tamping of holes.

Use fine tamping material, and tamp carefully.

The fuse may be cut off by adjacent shots.

Place the primers far enough toward the bottom of the hole so that this chance is eliminated.

Sharp bends in fuse may break the powder train.

Do not make sharp bends in fuse, especially if it is at all cold.

The wrong grade of fuse may have been used.

Be sure to use a waterproof fuse in wet work and a suitable fuse in other work.

The fuse may have been kept so warm that the waterproofing was affected by the heat.

Do not store or hang fuse too near stove, fire, or steam pipe.

FAILURE OF CAPS

The cap may become wet or damp in storage. The moisture can come in contact with fulminate in cap in many ways.

Always store caps in a dry, well ventilated place. Humidity alone without actual precipitation will make them wet or damp.

The water may drop into the cap, or the humid air of mines may condense in the cap.

Always keep the cap box in place protected from rain or other dripping water.

The water from wet hole may get into cap. If cap is not crimped tight with a wide-type crimper, the water will be forced through ridge left in cap no matter what waterproofing is used.

The cap should be crimped tightly on fuse with crimper that makes wide crimp and then, a few hours before it is used, the joint should be dipped in suitable waterproofing material.

Oil may get into the cap and make it non-explosive. Even highly inflammable oil will reduce the strength of the cap and it may drown the spit of the fuse.

Do not use any grease or paint containing light oil for waterproofing joint, as the light oil will work its way down through the slightest crack into the cap. Especially is this true if the cap is not tightly crimped with a wide-type crimper.

The leaking oil or nitroglycerin from leaky explosives will also work down into the cap and drown the spit of the fuse, even though this oil is in itself very inflammable. Even if nitroglycerin does not cause the cap to misfire, it actually does decrease the strength of the cap so that the explosive may not explode with full force.

Do not use leaky dynamite for making primers, if possible to avoid it. If it must be used, crimp the cap very tight; cover the joint and eight inches of fuse with a cap sealing compound, and do not put the caps into the leaky dynamite until just before loading the hole.

The caps may become wet from blowing into them.

Never blow into a cap to remove foreign material, as you may blow moisture into it. Tap the open end lightly on a dry piece of wood to get results.

Some foreign material, such as sawdust, may have got into the cap.

Remove foreign material by tapping the open end of the cap lightly on dry wood.

The fuse may be cut at such a slant that, on being inserted into the cap, the end may become doubled back and prevent powder spitting into the fulminate.

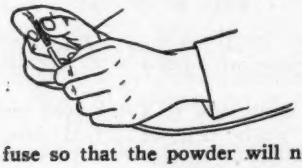
Always cut the fuse practically straight across with a clean, sharp blade.

The fuse may not be inserted all the way into the cap. It may very easily happen that the fuse is pushed only part way down to the fulminate, especially if it fits tight.

Make a fresh, clean cut off the end of the fuse with a sharp blade in such a way that the end will not be enlarged. Be sure to push the fuse clear down to the fulminate. It should not be necessary to use undue force. If the fuse fits too tightly, cut off another small piece and try again. If necessary, hold the end of the fuse upward and roll slightly with the finger and thumb, being careful that the powder does not fall out of the fuse.

The fuse may fail to ignite the cap because the powder has been removed from the end of the fuse.

If the end of the fuse is rolled with the end pointing in any direction except straight upward, the powder is apt to spill out and be lost. Avoid doing



Hold the fuse so that the powder will not spill out

this. If it is necessary to compress the end of the fuse by pinching or rolling, be sure the powder does not fall out.

Crimping cap with teeth or knife. This does not seal the cap all around the fuse, and waterproofing will not keep water out of these vents. Neither does this fasten the cap securely on the fuse.

Crimp caps on tight with an approved cap crimper which makes a wide crimp and cannot crimp fuse tight enough to stop the burning.

FAILURE OF SQUIBS IN BLACK BLASTING POWDER

A little water in the hole may prevent the squib from igniting the black powder.

Use a blasting barrel in wet holes; or use an electric squib instead of a plain paper squib.

A small piece of stemming may drop into the squib hole and cause a misfire.

Use a damp clay stemming of proper consistency and pack it thoroughly. Allow plenty of time before going back to a missed squib; then insert the needle in the hole again to clean it and try another squib.

Electric squibs are both surer and safer than common squibs and develop more force from the powder because they can be placed in the center of the charge.

FAILURES OF ELECTRIC BLASTING CAPS AND DELAY ELECTRIC BLASTING CAPS

Some electric blasting caps in a series may fail to explode, because of insufficient electric current, or because the voltage from the blasting machine is too low.

Be sure that you use a blasting machine of sufficient capacity and one that is in good condition. You can test it with a rheostat made for the purpose.

The blasting machine may not have been operated hard enough.

Always operate a blasting machine with all possible force to develop its full capacity. It is built to stand it.

The voltage in a power circuit may be too low or the amperage insufficient.

Be sure that the power line is actually delivering sufficient current and voltage at the time and place where the blast is made. A generator of sufficient capacity may be running at full speed, but unless it is actually delivering the power at the moment of firing, the interval of time necessary to build up the current will cause trouble.

Poor connections may reduce the current to a point where it will be too weak to fire all the caps.

Be sure not to make any loop connections; all joints in the wires should be good electrical connections with clean wires.

A break in the line will prevent the electric blasting caps from receiving current, and much time may be lost in finding the break.

Use a galvanometer for testing blasting circuits. It is made for that purpose and is safe to use. If a break occurs, it can be found in a few minutes with this instrument, eliminating loss of time and of output.

In scraping insulation from No. 18 and finer wire with a knife, the wire is often so nearly cut in two that it easily breaks later, causing a break in the circuit that is hard to find.

It is advisable to uncoil the layers of insulation on this fine wire, rather than scrape them off with a knife. It may take longer, but is safer and less likely to cause trouble.

Making parallel or multiple connections when firing with a blasting machine will cause trouble.

Always connect all your exploders in one series with a blasting machine; it does not develop sufficient current for multiple connections.

Two different makes of electric blasting caps in the same series or multiple series may cause misfires.

Always use electric equipment from the same factory in the same blast. Different factories use different ignition compounds and their electrical firing devices have different degrees of sensitiveness to the electric current.

A wet blasting machine or wet wire will lead to misfires.

Use the waterproof wire in wet work and be sure the blasting machine and wires are kept dry. Use a good grade of all materials.

In blasting wet shale, short or shunt circuits may cause holes in the middle of the circuit to misfire. The same trouble may occur in blasting deep water holes.

Use waterproof electric blasting caps with enameled wires.

If leading wires or connecting wires come in contact with rails or pipes, the current may be short circuited.

Do not let wires come in contact with any metal object which may cause a short circuit.

Failures with Delay Electric Igniters

Misfires may occur from the same causes as with electric blasting caps.

Use the same precautions as with electric blasting caps.

Misfires may occur from mishaps to the short piece of fuse used in the igniter.

Use the same precautions in the handling of this fuse as you do in using ordinary fuse, and especially in attaching cap to it. Be sure to cut at least ¼ in. off the end of the fuse in the igniter before attaching cap.

Forcing the igniter into a small hole in a stick of dynamite may break the rubber covering and uncover the gas vent in the igniter shell so that moisture can penetrate the ignition compound.

Use a large enough punch for making the hole in the stick of dynamite so that you do not have to exert force in inserting the igniter.

Punching a hole in the stick with the handle of the cap crimper

If the rubber covering becomes dried out, it will break easily and expose the gas vent to moisture.

Use fresh igniters. Be sure they are not dried out or old.

Too much pressure may force water through the cap joint and cause misfire.

After the cap is crimped tight to fuse, re-dip entire igniter in an approved cap sealing compound to make it doubly waterproof. It will then stand 10 lb. per sq. in. water pressure for an hour, and no misfire is likely to occur.

When delay electric igniters are used with black powder, the vent in the side of the shell will often cause an instantaneous ignition.

Always keep the igniter shell out of the powder. In large charges insert a shell in a cartridge filled with sand and let only the end of the fuse protrude into the powder.

Failure of a round may occur if the proper delay igniter is not put in each hole.

Have a blasting box or some very definite way of keeping your igniters numbered to avoid getting them mixed.

The use of one make of electric blasting caps in series with another make of delay electric igniters will usually cause misses.

Be sure that all electrical exploding devices in one blast are of the same make; no two makes can be used together safely.

All electrical blasting supplies are subject to deterioration in improper storage. Damp storage will sometimes cause copper on electric blasting caps or igniters to corrode and the corroded wire may break easily.

Be sure to store all electrical equipment in a dry, well ventilated place.

Misfires Due to the Explosive of Preparation of Primer Cartridge

Powder may be insensitive and fail to explode from being too cold.

Most explosives are now made low freezing, but to get the best results they should, if possible, be above the freezing temperature of water when used. With most explosives, the warmer they are the more sensitive they are and the surer their detonation. There are still some high-freezing explosives used and they chill at 50 deg. F.

Tie a cord around the cartridge

Explosives may be insensitive because of too much moisture. Five per cent or less of moisture will render some commercial explosives non-explosive.

See that the explosives are stored in a dry, well ventilated magazine and kept as dry as possible up to the moment of firing. If the work is wet, use a gelatin or some explosive that will withstand the water with which you must contend.

Explosives may be too insensitive on account of being too old.

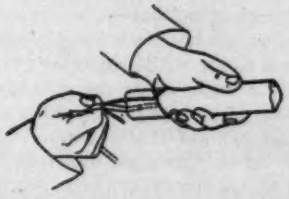
In proper storage many explosives will keep for years, but others are less longlived and may become too insensitive to be sure to explode.

Explosives may not be suitable for the work nor the conditions at hand.

Be sure to use a suitable explosive. Ask the manufacturer to examine work conditions and advise as to proper kind and grade of explosives to use.

Detonator, if not properly secure in the dynamite, may pull out and cause a failure.

Always see that the cap and fuse or electric exploder is securely tied or otherwise fastened to the stick of powder in which it is inserted. Cap must be wholly covered by the explosive.



The fuse and stick must be securely tied together

If fuse is laced through dynamite, the side spit of the fuse may cause the powder to burn instead of explode.

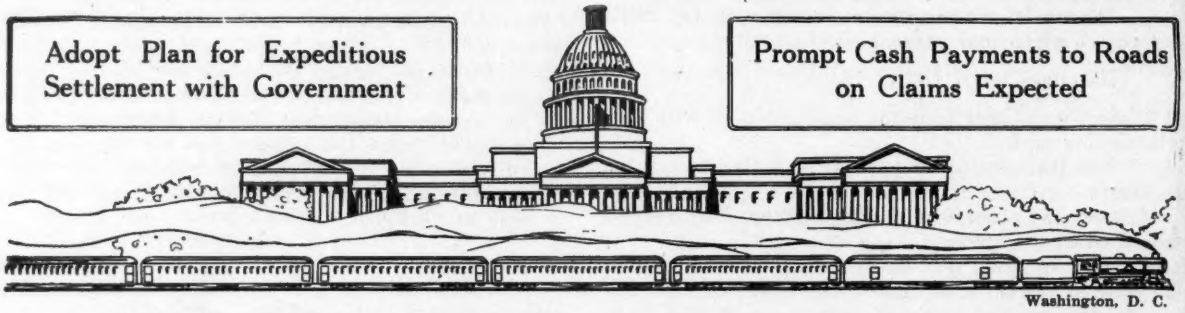
Do not lace fuse through dynamite.

Eliminating missed shots requires eternal vigilance. An occasional misfire may not be a sure sign of carelessness, because it really takes more than the normal degree of carefulness to avoid them altogether. The ordinary degree of care will eliminate all but a few occasional missed shots; and to get rid of these we must use an extreme degree of care. This may seem like expecting too much from the laborer, but, as a matter of fact, the extra time required is very small.

RAILWAY AFFAIRS AT THE NATIONS CAPITAL

Adopt Plan for Expeditious Settlement with Government

Prompt Cash Payments to Roads on Claims Expected



Washington, D. C.

A COMPROMISE plan for expediting the settlement of the accounts of the railroads with the Railroad Administration for the period of federal control, under which the roads will endeavor to reach an adjustment with the Railroad Administration without reference to that part of their claims for undermaintenance based on the inefficiency of labor, was accepted at a meeting of the member roads of the Association of Railway Executives in New York on July 20 and announced by President Harding on July 23.

Under the plan the indebtedness of the railroads to the government for the balance of the capital expenditures made on their property for additions and betterments during the federal control period will be funded for 10 years at 6 per cent, under authority conferred upon the President in his discretion by the Transportation act, and both sides agree to make every effort to bring about an expeditious settlement as to the amounts which the government owes to the roads for the balance of their guaranteed rental, interest on the unpaid balance and for the adjustment of the materials and supplies accounts. The railroads, however, do not waive their contract rights as to the obligation of the government for maintenance during the federal control period and if they are not able to effect what they consider a satisfactory settlement in any case they are free to seek further remedy in the courts on their interpretation of the contract. The funding of the additions and betterments will also make it possible for the Railroad Administration to pay some large sums to the roads on account prior to final settlement as much as it is willing to concede is due them without dispute. It has been making some such payments in the past, but heretofore has considered it necessary to withhold several hundred millions as an offset against the capital expenditures. It has been roughly estimated that this plan will release to the roads something like three hundred million dollars in cash, while the government will accept their negotiable promissory notes secured by bonds for $500,000,000 to $600,000,000 in connection with the funding plan. One of the principal motives of the administration has been to pay the railroads as much of the amounts which it considers fairly due to them as promptly as possible, on the theory that the placing of the money in circulation by the railroads will play an important part in stimulating the revival of general business. It is estimated that the railroads owe something like $250,000,000 to $300,000,000 for fuel bills, materials and supplies, and traffic balances between railroads and that this represents a large factor in the so-called "frozen credit" situation and that the payments to the roads will not only enable them to pay their bills, but also make it possible for them to increase their maintenance work and their purchases, thereby giving employment to many men on the roads and in the other industries.

The plan is the result of negotiations between the executive committee of the Association of Railway Executives and government officers which have extended over several weeks. It is understood that the negotiations were initiated by Samuel Rea, president of the Pennsylvania, who proposed such a plan as needed to relieve the critical condition of the railroads, in connection with his testimony before the Senate Committee on Interstate Commerce. Senator Cummins, chairman of the committee, interested himself actively in support of the plan and the recent negotiations on behalf of the government have been conducted mainly by Secretary Hoover of the Department of Commerce. Secretary of the Treasury Mellon, Chairman Clark of the Interstate Commerce Commission, Director General Davis of the Railroad Administration and Eugene Meyer, Jr., managing director of the War Finance Corporation, have also participated in the conferences and have advised the President on the subject.

The administration has all along been willing to give the railroads time to pay for the capital expenditures, which the railroads under normal conditions would take care of by issuing long term securities, but it has taken the position that the claims of the railroads, particularly those for undermaintenance based on the inefficiency of labor during the federal control period, were extravagant and so complicated as to delay a settlement. It therefore wished to use the leverage it possessed in connection with the funding to force a concession on the part of the railroads which would reduce their claims to a figure which it could pay without asking an additional appropriation from Congress.

The plan was tentatively agreed upon at a conference of the railroads' executive committee at Washington on July 18 and put up to the member roads of the association two days later in the form of a resolution which was adopted practically unanimously. The resolution does not bind the roads any further than the association is authorized to speak for them, because there is to be no modification of the terms of the contracts executed with the approval of the various boards of directors, but any road which is not willing to undergo the slow process of litigation while waiting for its money will undoubtedly follow the general procedure outlined.

The Railroad Administration has available only some $200,000,000 of its appropriation with which to pay settlements and the administration does not want to have to ask Congress for money, but a plan has been proposed by which the War Finance Corporation might furnish it by taking over from the Railroad Administration securities of the railroads such as the $310,000,000 of car trust certificates by which the standard equipment purchased by the Railroad Administration was funded. When market conditions improve it could sell the certificates.

The claims that have been filed with the Railroad Administration up to date amount to $756,000,000, but Director General Davis has estimated that on this basis the total claims would amount to about $1,250,000,000, of which $700,000,000 to $800,000,000 would be for under-

maintenance. He recognizes that the railroads are entitled to some compensation for undermaintenance, but perhaps half of the amount is figured on the basis of the inefficiency of labor, as a result of which the expenditure of an amount equal to the expenditures of the test period, even when equated for the increase in prices and in wage rates, did not produce a corresponding amount of work in the federal control period, and the officers of the Railroad Administration from the first have declined to allow any claims on this basis. They have already settled with 75 roads for less than 50 per cent of the amount of their claims and with the approval of the President have firmly refused to allow anything for the inefficiency item.

The President's Message

On July 26 the President addressed a message to Congress on the subject of relief for the railroads as follows:

"To the Senate and House of Representatives:

"The contract covering operations provides that the railways should be returned to their owners in as good condition as when taken over by the government, and the transportation act, recognizing that betterments and additions belong to capital accounts, provided that such sums as the railroad companies owed the government for betterments and new equipment, added during the period of government operation, might be funded.

Process Too Slow

"There has been at no time, any question about the justice of funding such indebtedness to the government. Indeed it has been in progress to a measurable degree ever since the return of the roads to their owners. It has been limited, however, to such cases as those in which final settlements with the railroad administration have been effected.

"Quite apart from the large sums owing to the government, which we are morally and legally bound to fund, the government admittedly owes the railway companies large sums on various accounts, such as compensation, depreciation and maintenance.

"There has been a wide difference of opinion relating to the amount the government owes, due in the main to the claim of the owners that in spite of materials and hours of labor estimated in proper relations to similar expenditures in the pre-war test period, the 'inefficiency of labor' still left a wide difference between actual upkeep and the expenditure made during government operation.

Waive Labor Claims.

"In order to expedite settlement and funding an informal understanding, which is all that is possible or practicable, has been reached under which the railway claims based on the 'inefficiency of labor' are to be waived to hasten complete and final settlements without surrender of any rights in court in case there is failure to settle.

"I have no doubt that early, final and satisfactory settlements will be reached, since the policy of the railway administration already has been effective in finally settling the accounts of railroads filing claims amounting to $225,568,764 resulting in the payment to them of $68,141,222.

"The way now would seem to be clear to very early adjustment and relief, except for the fact that the railway administration, though possessing assets, does not commend the funds necessary to meet what will be its admitted obligations.

$500,000,000 Sufficient.

"There is no thought to ask Congress for additional funds. Perhaps $500,000,000 will be necessary. The railroad administration has, or will have in the process of funding, ample securities to meet all requirements if Congress only will grant the authority to negotiate these securities and provide the agency for their negotiation.

"With this end in view you are asked to extend the authority of the war finance corporations so that it may purchase these railway funding securities accepted by the director general of railroads.

"No added expense, no added investment is required on the part of the government. There is no added liability, no added tax burden. It is merely the grant of authority necessary to enable a most useful and efficient government agency to use its available funds to purchase securities for which Congress already has authorized the issue and turn them into the channels of finance ready to float them.

"I can readily believe that so simple a remedy will have your prompt sanction. The question of our obligations cannot be raised, the wisdom of affording early relief is not to be doubted, and the avoidance of added appropriation or liability will appeal to Congress and the public alike."

This understanding relates wholly to the federal control period. The question as to the maintenance expenditures during the six months guaranty period which may be allowed in computing the railroad guaranty is in the hands of the Interstate Commerce Commission and its decision on the question is expected daily. The commission has already issued certificates to the roads for $420,000,000 on account of the guaranty, which have been paid by the Treasury, and this is said to represent about all that it can certify until the maintenance question is settled, while over $200,000,000 more is involved in that.

Roads in Nine Months Earn at Rate of 2.4 Per Cent

The railroads in the first nine months of operation under the new rates authorized by the Interstate Commerce Commission, effective last August 26, have earned a net operating income of $316,667,295, or at the rate of 2.4 per cent a year on the valuation tentatively adopted by the Interstate Commerce Commission for rate-making purposes. This represents a shortage under a 6 per cent return of $469,000,000. The net income for May was somewhat better than it had been for previous months of this year, about $37,000,000, but it represented largely the postponement of maintenance work rather than a real saving in expenses. The results under the new wage scales which went into effect on July 1 will not be known until the latter part of August.

Chairman Edgar E. Clark of the Interstate Commerce Commission has submitted to the President his resignation, to become effective on August 31, and the President has sent to the Senate the nomination of Frederick I. Cox of New Jersey to succeed him. Mr. Cox is connected with the National Council of Traveling Salesmen's Associations and was an active candidate for appointment to the commission at the time of the latest vacancies. Chairman Clark's resignation came as a surprise, as he was recently re-elected chairman for the new fiscal year. It was announced that he feels that he has reached the time of life when he can no longer afford to devote himself to public service. He has been a member of the commission since 1906, and was its senior member.

UNUSUAL OLD RAILS FOUND IN TRACK

IN TAKING up an industry track of the Big Four near Dayton, Ohio, which was abandoned along with other lines incident to the flood control work in progress in that vicinity, the reclamation forces recently found two unusual sections of rail which, although still in service at the time, gave evidence of having been rolled at a very

Cambria Welded Pear-Headed Rail, 1859, Showing Passes

Historical Development of American Rail

The Historical Development of American Rail Sections

early date. These rails are unusually interesting from both the historical and metallurgical standpoint. According to the account taken from the Miami Conservancy Bulletin, they were removed from a siding serving a mill three miles northeast of Dayton, which is reported to have

been built in the early fifties. Both sections were pear shaped, and one rail was found to have a hollow head, effecting about a 10 per cent reduction in material over a solid section. The solid section rail weighed 57.6 lb. per yard and the hollow section 54.6 lb. With the co-operation of several parties, chief among which were Robert W. Hunt & Company and the Lackawanna Steel Company,

A Sulphur Print of the Rail

physical and chemical analyses were made of the rails and various records examined in an effort to identify them. The conclusion was reached that they were undoubtedly the products of the Cambria Iron Works of Pennsylvania, and in all probability were laid as early as 1860, or five years before the transition from wrought iron to steel in rail manufacture had its beginning. In this connection reference is made to one of the two illustrations, the upper portion of which is a reproduction from the records of the Cambria Company showing the successive passes in a process of rolling a rail of the section found in the Big Four track. The lower portion of the same illustration is likewise interesting in showing the successive stages in the development of American rail manufacture.

The results of analyses made upon the rails are as follows, the first two having been made of metal from the entire sectional area and the third of the metal in the head only:

	Per Cent				
	Carbon	Manganese	Phosphorus	Sulphur	Silicon
Solid rail...	0.04	0.025	0.552	0.067	0.212
Hollow rail.	0.03	0.013	0.254	0.209	0.184
Hollow rail.	0.005	0.085	0.49	.....	.....

In order to show the difference between this and present day rail materials, typical analyses of open hearth and Bessemer rails of this weight are given below:

	Per Cent				
	Carbon	Manganese	Phosphorus	Sulphur	Silicon
Open hearth.	0.57	0.75	0.035	0.055	0.12
Bessemer ...	0.42	0.95	0.10	0.070	0.12

Supplementing the chemical analyses a sulphur print was made, which shows by the shaded areas that the impurities appear to be concentrated in the web and base of section with little in the head.

Labor Developments of the Month

CONSIDERABLE unrest was displayed for several days prior to July 1 in the action which the labor organizations would take with respect to the recent wage cut ordered by the Railway Labor Board, effective July 1. The maintenance of way employees, clerks and shop men were particularly opposed to accepting the decreases and it is understood that strike votes in each of these organizations resulted in a majority in favor of a fight. However, a more conservative attitude on the part of the train service brotherhood exerted a restraining influence. This was particularly apparent in the meeting of the general chairmen and chief executives of the labor organizations held in Chicago on July 1, and for several days thereafter. When the train service brotherhood adopted the resolution providing for a referendum vote of the membership of their organization to be taken not later than September 1, the maintenance of way and shop men found themselves without support for any immediate action and were in consequence compelled to follow the lead of the more conservative brotherhoods and will probably accept the wage reductions under protest.

THE PENNSYLVANIA CASE

By far the most interesting development of the month is the action taken by the Pennsylvania System jointly with its employees at the Altoona shops. As a result of negotiations between the railroad and the employees, independent of any representation or assistance by the shop-crafts branch of the American Federation of Labor, a local organization known as the Altoona Works Employees' Association, has been formed. Officers have been elected by a secret Australian ballot supervised jointly by the management and the employees to represent the employees in their dealings with the management. In this way arrangements have been made for local shop committees and for a works council composed of all the local committeemen. This organization, together with representatives of the management, have drawn up rules which have been agreed upon by both parties that provide for the following arrangements, which differ essentially from those contained in the National Agreement:

1. Re-establishment of piece work under the principles previously announced by the railroad, namely, under rates set so that piece workers can earn a rate which is higher than the day-work rate which may from time to time be established for day-workers.
2. A 48-hour basic week, with not more than 9 hours on any one day, or less than 8 hours on any day except Saturday. This permits the men to decide for themselves whether they shall work 8 hours per day or more than 8 hours on some days during the week, in order to get a half holiday on Saturday.
3. Where reduction in expenses becomes necessary, it may be accomplished either by reduction in force or reduction in hours of work, as the employees themselves decide.
4. Overtime to be paid *pro rata* for the ninth and tenth hours and time and one-half after the tenth hour.
5. Seniority based on length of service with the company, rather than length of membership in a particular craft.
6. Classification of work under a wide spread of rates, which permits the establishment of rates of pay based on skill required, rather than a flat rate, and gives a man doing more important work a higher rate of pay.

This arrangement has been opposed strenuously by the labor representatives before the Railway Labor Board and the hearings to consider this action of the Pennsylvania took place at Chicago on July 14 and 15. It was the contention of the labor representatives that this arrangement violates a number of the principles outlined by the labor board in its decision, No. 119, abrogating the national agreements. The board was requested to render an interpretation on the following points:

"(a) The right under principle 15 (of Decision No. 119, abrogating national agreements) of the majority of the employees of any craft to determine what organization shall represent them.

"(b) The right of such organization to negotiate agreements for all members of such crafts through designated representatives of their own choosing without regard to whether they are in the employ of the carrier with which negotiations are to be conducted.

"(c) The right of the organization under principle 5 (of Decision 119) to select such representatives in accordance with its own laws, and without interference by the officers of the carriers."

The ballot which the Pennsylvania took for the election of representatives to confer on rules and working conditions was objected to on the grounds that it provides, first, for the election of individual representatives, and not organizations; second, that it ignores the organizations of employees now in existence, and, third, it provides for the division of the Pennsylvania into several regions, and the negotiations of different agreements in several regions. Considerable testimony in the hearing also hinged on the matter of the number of shop employees who voted in the election for representatives, it being contended by the labor representatives that a large portion of the employees refused to participate in the ballot.

The position of the Pennsylvania was defended by E. P. Whiter, E. H. Seneff and others. Mr. Whiter said in part:

It must be evident to this board that while the Pennsylvania is anxious and willing to assist the Board in carrying out the Transportation Act, it cannot consistently comply with Section 301 of that Act, which requires that disputes shall be considered and, if possible, be decided in conference between the representatives designated and authorized to confer by the carriers and the employees or subordinate officials directly interested in the dispute, and at the same time carry out rulings of this Board which are so diametrically opposed to this section and to the best interests of the railroads, the public and the employees. We share the Board's desire to avoid any interruption of traffic and to live up in letter and spirit to the mandates of the Transportation Act; that every means be taken to settle controversies that may endanger the continuous operation of the carriers. As far as the Pennsylvania is concerned, however, there is no danger of any substantial interruption of transportation. Railroad employees who prior to federal control lived harmoniously with their employers over a long period of years on the basis of just such relationship as we are re-establishing with our men, do not strike without just cause.

Mr. Seneff contended that the labor board had greatly exceeded the authority granted it by the Transportation Act, declaring that the 16 principles outlined by the board in its order No. 119 constituted an attempt to legislate respecting property rights and obligations of the carrier and the employee, and that no such power had been delegated to the board by Congress.

Following the closing of this hearing, the case was taken under advisement by the labor board in executive session, and no decision had been given out at the time of going to press.

OVER 600,000 EMPLOYEES LAID OFF

According to statistics of the Interstate Commerce Commission, the total number of employees of Class 1 railroads on the payrolls in March, 1921, decreased 604,756, or 27.5 per cent from the number in the employ of the railroads in August, 1920. The number employed in August was 2,197,824, while the number in March was 1,593,068.

The following table gives some interesting statistics as applied to officers and employees of the maintenance of way department, although in some cases the classification includes also persons in other departments. This decrease is, of course, partially accounted for by the normal seasonal reduction of maintenance forces during the winter months:

EMPLOYEES BY CLASSES—CLASS I ROADS.
August, 1920, Compared with March, 1921

Class of employee	August, 1920	March, 1921	Decrease	Per cent of decrease
Assistant engineers and draftsmen	11,020	8,979	2,041	18.5
M. W. & S. foremen	8,838	6,312	2,526	28.6
Section foremen	42,834	39,839	2,997	6.9
Section men	365,818	173,917	191,901	52.5
Foremen of const. gangs and work trains	1,996	942	1,001	50.9
Other men in const. gangs and work trains	34,549	10,058	24,491	70.9
Masons and bricklayers	1,274	577	697	54.7
Structural iron workers	900	556	344	54.7
Carpenters	56,240	33,847	22,393	39.8
Crossing flagmen and gatemen	26,399	23,191	508	1.9
Drawbridge operators	1,738	1,517	221	1.3

To keep thoroughly in line with reductions in wages to employees a number of the railroads have made corresponding reductions in the salaries of officers of all classes, these reductions in most cases being on a straight percentage basis. While such reductions have not been formally announced in all cases, definite statements of such action have been given out by the Chicago, Rock Island & Pacific, the Pennsylvania and the Baltimore & Ohio.

WAGE REDUCTIONS IN CANADA

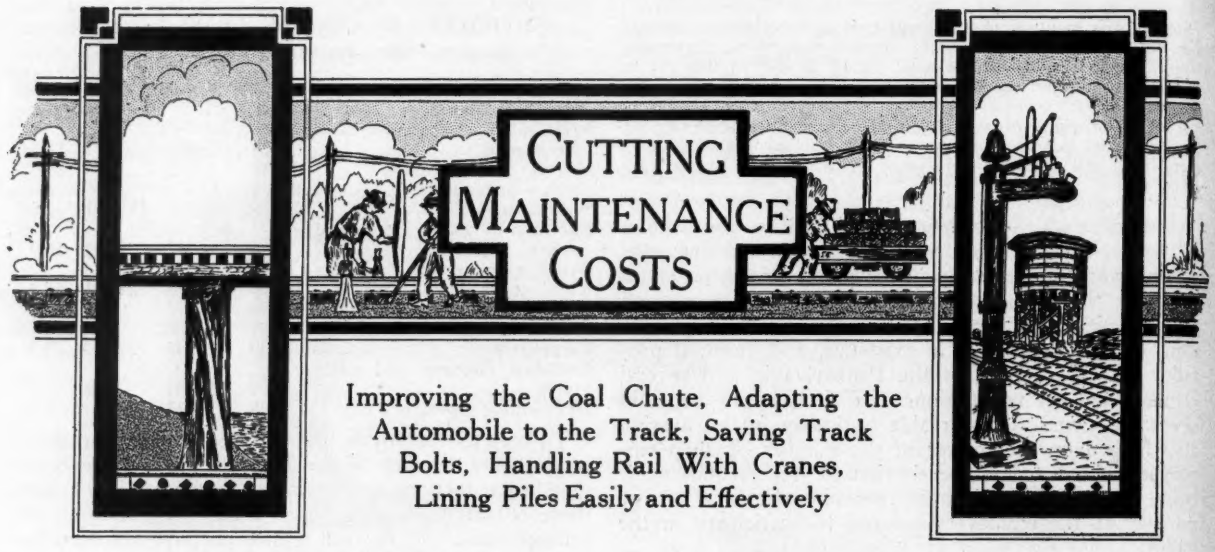
In Canada tentative wage reductions for maintenance of way and shop employees have been agreed upon between the roads and the men. The reductions range from 7½ cents to 10 cents per hour. The new scale became effective on July 16 and will reduce the wages of about 40,000 workers. The text of the agreement as affecting maintenance of way and signal forces is as follows:

"It is agreed tentatively, and without prejudice to pending negotiations for revision of the agreement covering rates of pay and rules governing the service of employees in the maintenance of way department as specified in Wage Agreement No. 5 between the Railway Association of Canada and the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers, that, effective July 16, 1921, the railways will apply and the employees will accept the following changes in rates of pay as compared with rates of pay as specified in existing schedules:

	Decrease of: Per Day Dollars
Section foremen, assistant section foremen, foremen of extra gangs, assistant foremen of extra gangs, snow plow and flanger foremen, bridge and building foremen, painter foremen, mason, concrete, bricklayer and plasterer foremen, pile driver, ditching and hoist engineers	$ .80
Foremen of signal and interlocking construction gangs	.80
	Per Month Dollars
Pumpmen	$17.34
Signalmen at interlocked crossings	12.24
	Per Hour Cents
Carpenters, bridgemen or rough carpenters, painters, plumbers, pipe fitters, tinsmiths, blacksmiths, pump repairers, masons, bricklayers and plasterers	$ .10
Bridge and building laborers (west of Port Arthur and Superior Junction)	.08½
Track and bridge watchmen, signalmen or watchmen at highway or railway non-interlocked crossings, signalmen at highway or railway (half interlocked) crossings, bridge tenders	.08½
Signal and interlocking maintainers and repairmen	.08
Helpers to signal and interlocking maintainers and repairmen	.07½
Helpers to all other mechanics in maintenance of way department under Section 22, Wage Agreement No. 5	.07½
Sectionmen	.08½

"It is also agreed that, promptly upon notice from either the Railway Association of Canada or the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers to the other, the representatives of both will confer further and that, except as may be otherwise mutually arranged, any rates and conditions finally agreed upon will be effective as from July 16, 1921.

"Any necessary adjustments will be made accordingly, provided, however, that any such adjustments will not operate to bring about any reclaim from employees of any amounts which may have been paid to them pursuant to the terms of this tentative agreement."



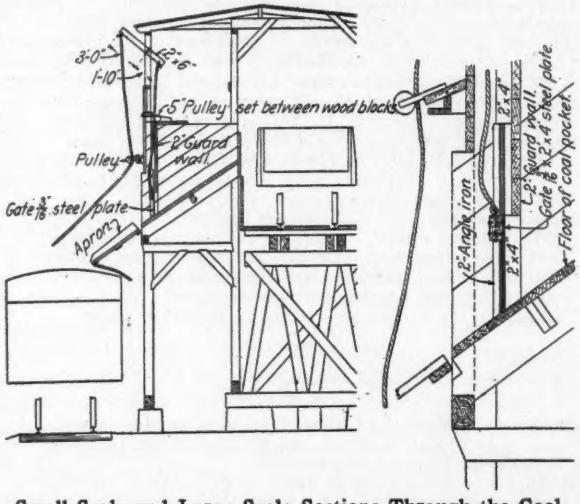
Improving the Coal Chute, Adapting the Automobile to the Track, Saving Track Bolts, Handling Rail With Cranes, Lining Piles Easily and Effectively

AN IMPROVEMENT FOR COAL CHUTES

By Leo D. Garis

Office of Division Engineer, Chicago & North Western, Winona, Minn.

A NEW GATE has been applied to some of the old Clifton coal chutes on this division as a part of a campaign for reducing the amount of labor required for handling these chutes. These coaling stations are not operated as a part of the regular engine terminal equipment, but serve as an auxiliary supply for engines between terminals. They are of the type in which the gate is kept closed by the apron when in the raised position and the coal is released by simply pulling the apron down into the operating position, whereupon all the coal is discharged from the pocket since there is no way of shutting it off once it has been started.



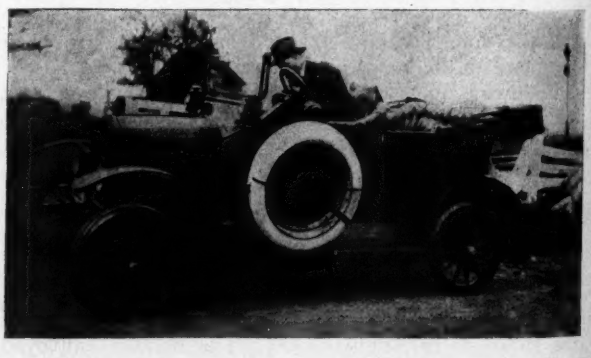
Small Scale and Large Scale Sections Through the Coal Pockets

In order to make it possible for the engine crews to take different amounts of coal under this arrangement, it was necessary to fill the pockets with different amounts of coal and mark these quantities on the back of the apron. This, of course, wasted a large part of the pocket capacity and required a larger amount of labor in operating the chute than would be the case if each pocket could be filled to the full six tons.

To overcome this a self-closing gate was applied to each pocket with as little modification of the chute as possible. The device was installed by building a 2-in. plank guard wall 10 in. behind the front wall of the pocket and from the top of the pocket to within 20 in. of the floor. Between this guard wall and the front of the pocket a gate of 3-16-in. steel plate, made the full width of the pocket and 2 ft. high, is installed so as to slide between a 2-in. angle iron and a 2-in. iron strap. By means of a rope and a lever located near the roof of the house, it is possible for a fireman standing on the engine to lift this gate after lowering the coal chute apron. The pockets are designed to hold six tons and if the fireman should need only two tons, all that he has to do is to let go of the rope and the gate, which weighs approximately 80 lb., drops and shuts off the coal. It does this very efficiently.

MAKING A FORD DO DOUBLE DUTY

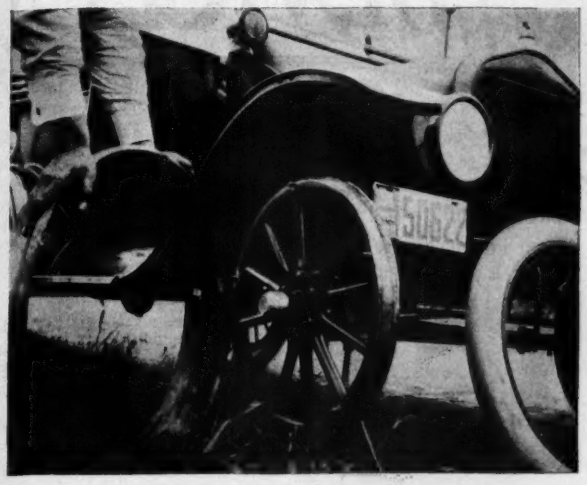
RAILWAY officers have long utilized the automobile as an aid in the conduct of their regular duties. This has generally been accomplished through the installation of special wheels flanged and of the proper gage for use on standard gage tracks. As a rule, the cars so constructed have been used solely as a railway proposition, no attempt being made to make them quickly convertible for either track or highway use.



Ready to Drive on the Track

In the Ford car shown in the illustration, a successful endeavor was made to secure an arrangement that would permit of double duty for the car. This was obtained by designing flanged steel rims which could be mounted on

the wheels and held by the same stud bolts and clips used for attaching the pneumatic tires. When used for traveling along the highways, the steel rims are strapped on the side and rear of the car. The procedure in preparing it for railway use is simple and quick, the time consumed being about 20 min. The car is driven up near the tracks and each wheel jacked up and the rims changed in the same manner used for pneumatic tires. After strapping the regular tires on the machine it is driven on the tracks.



Changing Rims Preparatory for Railway Use

It is possible to remove the car, or to turn it on a farm or highway crossing by releasing the clamp on the steering gear and using two small wedges in front of the front wheels. These wedges are only of sufficient height to lift the flanges level with the head of the rail, after which the car can be driven off under its own power.

A point of interest is that in case of engine trouble or breakdown, it has been found possible to secure the necessary help and repair parts at almost any point along the line. A great deal of time has also been saved in the inspection of branch lines in that it is possible in many instances to cut across country between the ends of the lines.

We are indebted for this information to J. M. Silliman, Montreal, Canada, who used the car illustrated when division engineer on the Canadian Pacific.

SAVE TRACK BOLTS BY KEEPING THE CUT ENDS OF NUT LOCKS DOWN

By C. S. Lusk

Section Foreman, Erie Railroad, Alfred Station, N. Y.

WHEN TIGHTENING track bolts I have accustomed myself to notice the position occupied by the nut lock on each bolt and as a result of my observations I am convinced that in 80 per cent of the cases where the nuts have become set on the bolts and break off when an attempt is made to tighten them, the damage results from letting the nut lock take such a position that its open or cut ends are on the upper side of the bolt. Breakage is particularly prevalent in the case of ¾-in. bolts found with the nut locks in this position, and although there is less breakage in the case of the 1-in. bolts it is noticed that almost always these bolts as well as the smaller ones are difficult to tighten. The nut locks cause this trouble, because while in this position water can run into them and collect around the bolt. Obviously the way to stop the trouble is to keep the open ends down.

A method of doing this is to make a light cut on the splice bar just below each bolt hole, using a cold chisel and holding it at an angle to form a shoulder for the end of the nut lock. This can be done just before the bar is applied, but where it has not been done, and the nut locks are found to be turning on the bolt, it will generally pay to remove the bolts and do so at the next tightening.

THE USE OF TWO LOCOMOTIVE CRANES FOR LOADING AND UNLOADING STEEL RAILS

By George T. Donahue

Assistant Supervisor of Track, New York Central, Rochester, N. Y.

ON ANY subdivision where there are two locomotive cranes or derricks, a great saving can be effected when loading or unloading rail by working two cranes in the one work train. The amount of rails unloaded or loaded in this manner is just double the amount accomplished with one crane.

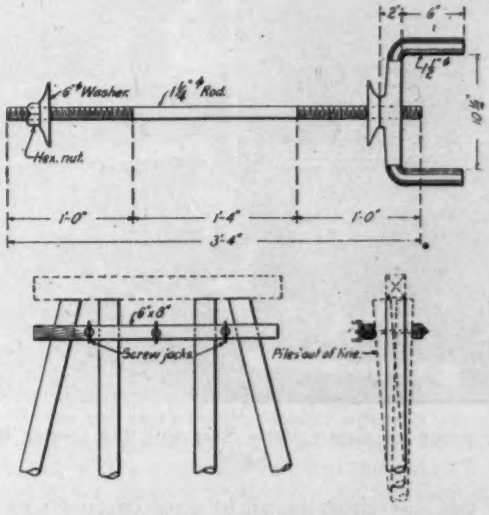
This means that one engine, an engine crew and train crew are saved. In busy seasons they can be used for other purposes, such as unloading ties, etc., where cranes are not essential, but will be found economical. Thus it is seen that with the same equipment and crews as would otherwise be used when working the cranes in separate work trains one can unload the same amount of rail and in addition have another engine and crew available for another day's work.

A DEVICE FOR LINING PILES

By D. B. Johnston

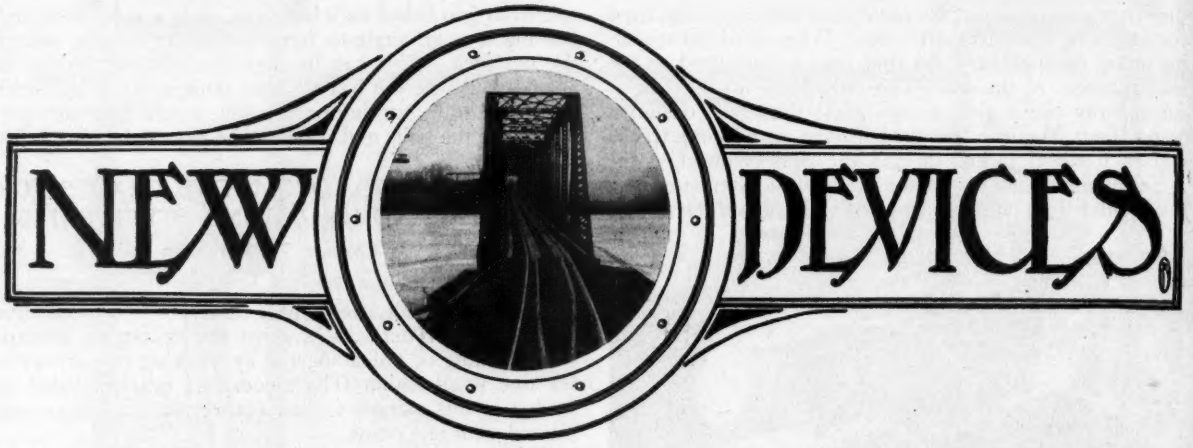
Division Engineer, Pennsylvania System, Louisville, Ky.

AFTER THE PILES in a bent have been driven, before the caps and bracing can be applied it is necessary to draw the piling into line and this is usually done by the use of pulling jacks and wedges and blocks, all operated in cramped quarters. As an improvement the



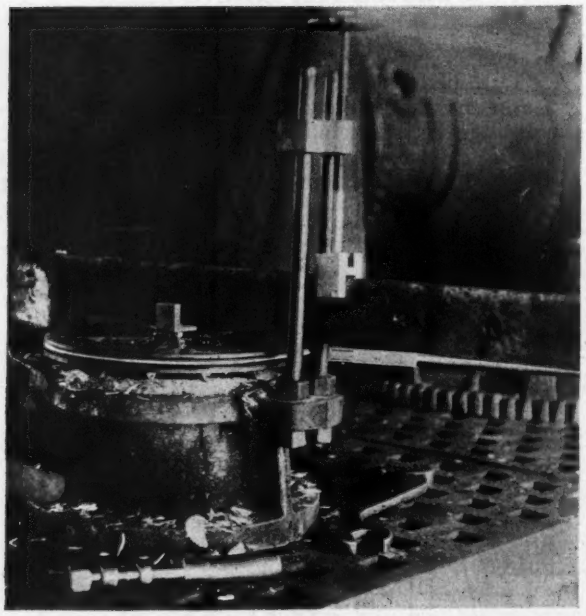
The Clamp and How It Is Used

device illustrated was developed and has been found easy to apply and positive and powerful in operation. It consists of two 6-in. by 8-in. timbers placed on either side of the row of piles, and drawn together with the aid of the 1¼-in. bolts, which are drawn up by turning the two-handle nuts shown. Where five-pile bents are standard, four screws are used, but it is well to carry about a dozen in order that work may be under way on more than one bent at a time. After the cap is in place the device is removed before the bracing is applied.



A TOOL FOR REPAIRING OUTLET VALVES IN RAILROAD TANKS

IT OCCASIONALLY HAPPENS from accident or prolonged abuse that the babbitt seat on the valve body of outlet valves for railroad water tanks becomes so badly defaced as to require a new babbitt seat or resurfacing to prevent extensive leaking and wastage of water when the valve is closed. When the condition of the seat is



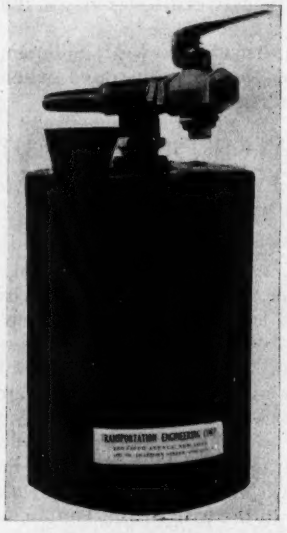
Resurfacing an Outlet Valve Seat with the Dexter Rotary Cutter

such that the repairs cannot be made effectively by hand methods, the one alternative has been to remove the valve body from the tank and send it to a shop. This may require considerable time, however, and necessitate shutting down the tank for a longer period than is permissible. To meet a condition of this kind, an interesting device has recently been developed by the Leavitt Machine Company of Orange, Mass.

This device, called the Dexter rotary cutter, consists of a cutter holding plate equipped with a set of triangular cutters and provided with an operating lever of the friction ratchet type whereby resurfacing may be accomplished by attaching the plate to the tank valve body as shown in the illustration and rotating it by means of the lever. Each cutter has three cutting edges and is reversible, by reason of which each cutter can be used for long periods before regrinding is necessary. In cases where rebabbitting of a valve seat as well as resurfacing is required, a form plate need only be provided in addition to the rotary cutter to permit of the work being performed without removing the valve body. The plate should be slightly larger in diameter than the top of the valve body, grooved on one side to conform to the desired shape of the valve seat and provided with the necessary holes for the pouring of the babbitt and the escape of the entrapped air in the mold. Preparatory to pouring, the plate is clamped on top of the valve and puttied around the edges. When the seat is moulded it then remains but to clamp the cutter in place and give the babbitt a proper surfacing.

A PORTABLE SAND BLAST FOR WELDERS

IN BOTH electric arc and oxy-acetylene welding it is important that the parts to be welded be cleaned thoroughly before the welding operation is started. All rust, scale, oil, sand, etc., should be carefully removed. It is also necessary to remove the scale and oxide from the deposited metal from time to time as the weld progresses so as to avoid slag inclusions between the layers.



The Portable Sand Blast

This cleaning work has generally been accomplished by the cold chisel, hand pick, roughing tool or wire brush. Such tools are not always entirely satisfactory, however, and for that reason maintenance men will be interested in the portable sand blast, shown in the illustration. This device has been introduced by the Transportation Engineering Corporation, New York City.

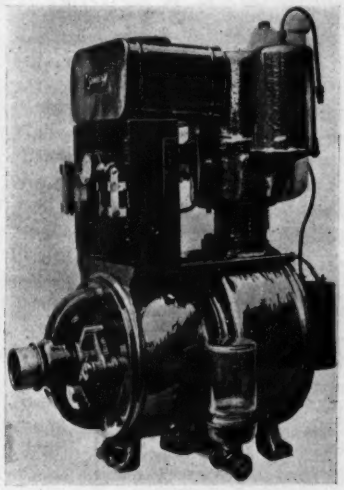
The sand blast consists of a heavy sheet metal tank of about four-quart capacity, provided with a filling hole and

an air-operated syphon. The syphon consists of a sand pipe, extending to the bottom of the tank, a pipe tee, an air nozzle, and a sand nozzle. The sand nozzle is case-hardened and is provided with a renewable tip. A trigger valve is provided, as shown, for controlling the blast of sand. An air hose with a ⅜-in. nipple is attached to the open end of the valve, after which the sand blast is ready for use. An air pressure of from 75 to 100 lb. is required for the most efficient operation of this device.

A SMALL ELECTRIC LIGHTING PLANT

IN RECENT YEARS the railroads have shown a marked readiness to provide electric lighting wherever it could be done effectively and economically, and as a result it is customary to find buildings at terminals or other points located conveniently to transmission lines or other sources of power so lighted. In the light of the progress which already has been made in this respect, it is but reasonable to suppose that the application of electric lighting will be extended as rapidly as equipment is developed of a nature to make this possible.

In this connection it is of interest to direct attention to an electric lighting system adopted for use where the demand for electricity is comparatively small, such as at way stations, in coaling plants, pumping stations, at interlocking plants, or upon construction jobs performed at night. This system is a combined dynamo and storage battery outfit driven by a gas engine and is adapted to lighting 43 lights of 14 candle power or 15 watts each. The engine is a 1½ hp. machine, direct-connected to and self-contained with the dynamo, and the unit is connected with 14 storage batteries in such a manner that it starts, runs, regulates and stops itself, it being necessary only to switch on the lights at the socket or switch as is done in the larger lighting systems. In the operation of the plant when the demand for light does not exceed 150 watts (six or ten lights) the energy is furnished entirely by the storage battery. When additional lights are turned on the gas engine is started automatically by the current supplied to the dynamo from the storage battery, the generator set thereafter supplying all the power for the light and in addition charging the storage battery until the demand again falls below 150 watts, whereupon the load is again carried by the battery. A lever is also supplied in this plant for starting and stopping the set where it is desired to recharge the battery or utilize the power of the outfit for other purposes than lighting, such as operating tool grinders, etc. It is claimed that no more than a day once or twice a week is required in recharging the battery and that the plant is capable of dependable operation over long periods without attention. This outfit is manufactured by the Sunbeam Electric and Manufacturing Co., Evansville, Ind.



The Sunbeam Electric Lighting Generating Set

A SAFETY CAR BLOCK FOR SIDINGS AND YARDS

A SAFETY car block which can be installed as a part of the track structure on sidings, yard tracks, etc., and utilized as needed has recently been put out by the Johnson-McGowan Company, Lynn, Mass. These blocks, of which two are used for each installation, have been designed to fit and lock properly on any size of rail from 4 in. to 5½ in. in height. The device consists essentially of the stopping block itself, which is hinged to a base plate on one side of the rail and made to lock with another on the other side of the rail. They can thus be swung in and out of the operating position by the switchmen. The upper inclined face of the blocks has the same traction surface as the rail and as the curve of the face has the same radius as the average car wheel, the wheels of a car are forced to rise vertically in order to pass over. When locked into position the inclined part of the device has a three-point contact under the ball of the rail, which, in connection with the locking action of the outer lever, holds the device firmly in place.

A Pair of Johnson Safety Car Blocks in Place

In recent tests on the Boston & Maine it was found that a car running less than 10 miles an hour would be stopped completely, while, when running between 10 miles and 12 miles an hour, the first pair of wheels passed over, the car stopping on the second pair.

SOUTHERN PACIFIC TRACK INSPECTION AWARDS

THE RESULTS of the 1920 track inspection of the Southern Pacific System has just been given out in detail in the form of a printed report. Based on an inspection made last fall awards were made for the best division, the best roadmaster's district and the best section. The division award was accorded to the Tucson division, William Wilson, superintendent, with a score of 93.52; the best mark for roadmaster's district was given to the San Jose district of the Coast division, M. Lahey, roadmaster, with a score of 96.22, and the award for the best section was given to Section No. 26, San Gabriel district, Los Angeles division, Dominick O'Donnell, foreman, with a score of 99.2. As premiums for these awards, Mr. Lahey and Mr. O'Donnell were each given a gold medal and in additional silver medals were granted to 39 section foremen having the best sections on the 39 roadmasters' districts. Favorable mention was made also of nine section foremen, whose sections received the highest scores on particular districts, but who were not eligible for the premiums because of extra gang work done on their sections previous to the inspection. In addition to these prizes silver medals were awarded to 130 station agents, 69 pumpers, and 12 power plant operators.

SOME TIME AGO a railway officer and reader of the *Railway Maintenance Engineer* expressed himself somewhat in these words: "I consider the idea behind the 'What's the Answer' column a good one, at least from the standpoint of my department, and I don't see any reason why it shouldn't be for the other departments which it covers. I am a regular reader of it myself and so are my men. My attitude toward it is that it can't do us any harm to read it and it is more than likely to do us good even if we don't get any more out of it than to find out how somebody else does the thing we do or what his opinions are. I think the value of the 'What's the Answer column could be increased, however, if there were more discussion of the questions, that is, if more than one answer were given to each question or if readers were given the benefit of the discussion that arises when the answers submitted are read."

The suggestion is a good one. The answers thus far have been contributed by men of experience and position and are of practical value to the men in the field. It is quite likely, however, that many of the questions which have been given heretofore or that will be published in the future allow for differences of opinion, and also that the answers contributed furnish a basis for argument, which, if carried on in these columns, would be of value if in no other way than in setting the readers and possibly the contributors to thinking more seriously about the subject than they might be inclined to do otherwise. In this connection it is interesting to note that just such a discussion occurs in this issue. On the subject of laying pipes, two answers have been contributed in which the opinions as expressed differ somewhat. The laying of pipe lines is undoubtedly an important maintenance of way task on all railroads and a discussion of this kind, therefore, is welcome. Furthermore, if the opinions expressed do conflict it will be all the more valuable to have the subject discussed further in a later issue. In this respect the "What's the Answer" department of the *Railway Maintenance Engineer* can render a particularly valuable service to its readers.

What Would Be Your Answer?

The following questions have been submitted and will be answered in the October issue:

(1) Is it proper to place the humped side of a crooked tie upward in the track, and what makes this desirable or otherwise?

(2) On a small concrete job the supply of water was obtained from a locomotive tender through the injector and the question was raised as to the wisdom of using this water before it had cooled off. Would it be injurious to use the water while hot?

(3) Why is it necessary to ventilate the air space under a floor where there is no basement?

(4) Should the intake pipe of a pump be larger than the discharge pipe and if so, how much and why?

The following answers have been received to questions published in the June issue.

WHY "SIGHT" ALONG THE OUTSIDE OF THE LOW RAIL?

Why continue the time-honored practice of surfacing the low rail on a main line curve by sighting along the outside of the rail, in preference to sighting along the gage side?

It will be granted, I think, that the eye can be trained to surface with an equal degree of accuracy from either side, excepting, of course, where very sharp curvature is involved, which, however, is beside the point in question. The greater safety to the man from having his body placed outside the rail, when sighting is done along the gage, is obvious. Elimination of lost motion in clearing the line of sight of the tools and bodies of the laborers, who are engaged generally in such surfacing along the outside, is a further feature recommending this practice. In the case of a worn low rail, finer results in surfacing are bound to result from sighting the inner surface, particularly where canting of the rails has not been practiced.

W. F. RENCH.

WATERPROOFING CONCRETE SLABS

Under what conditions is it necessary to waterproof a concrete slab or arch structure carrying ballasted track?

The conditions under which it is necessary to waterproof a concrete slab or arch structure carrying ballasted track involve two different viewpoints. One of these is the use the structure serves, the other the need of protection for the structure itself. In the former case, the structure must be waterproofed whenever it is of a character such that the area underneath it must be protected from dripping or moisture, as in the case of city subways, or slabs over station buildings under the track. Such waterproofing must take care of any water passing through the joints that may exist in the structure.

In the latter case the concrete surfaces in contact with

the ballast must be sealed to prevent seepage, wherever the conditions prevent prompt drainage of any water that filters through the ballast to them. The importance of making proper provision for the protection of the structure itself from damage by moisture does not always receive the attention in the design of the structure that it should, and in cases where it is doubtful whether water will be shed quickly from the concrete surface under the ballast, waterproofing should be employed. Neglect to provide adequate waterproofing is the cause of much unsightly efflorescence on the spandrel walls and soffits of arches. To avoid disfiguration in the exposed concrete surfaces by stains, the water drained from the interior surface in contact with the ballast should not be allowed to flow directly over them.

L. D. HADWEN, engineer masonry construction, Chicago, Milwaukee & St. Paul.

THE CARE OF DOWN SPOUTS

What can be done to get better service out of down spouts and gutters on station buildings?

The first requirement to get good service out of down spouts is good material. At present this seems to be restricted almost entirely to galvanized sheet metal, but the man in charge of buildings must satisfy himself that this sheet metal is the best to be had. It must be of good weight, not less than 22 or 24 gage, and properly galvanized. A number of different kinds of material are to be had and the officer must arrive at his own conclusion as to which of these will serve his purpose the best. The best is none too good and unless properly taken care of will not last very long.

There is no secret formula for making gutters and downspouts give good service. The main thing is to keep them clean and to keep them painted. This applies particularly to the gutters, which must be painted on the inside. The galvanized metal will not take paint readily when new, unless especially treated, but after six months' service the surface will be in a condition to take paint and from that time on it should be painted whenever an inspection shows that it is necessary.

SUPERVISOR OF BUILDINGS.

LAYING CAST IRON PIPE

Should a cast-iron pipe be laid so that the water will flow from the spigot end of the pipe into the bell end or the reverse? Is the answer affected if the pipe is on a steep slope, say, up to 45 deg.?

FIRST ANSWER

Pascal's law, one of the most important in hydromechanics, is as follows: "The pressure per unit of area exerted anywhere upon a mass of liquid is transmitted undiminished in all directions, and acts with the same force upon all surfaces in a direction at right angles to those surfaces." The pressure per square inch within a pipe line is therefore equal in all directions, downwards, upwards or sideways, and is independent of the shape or size of the pipe. The thrust is lengthwise with the pipe and is the same in both directions. Therefore, the direction of flow is immaterial so far as the effect of thrust upon the stability of the joint.

Leakage through a joint is due to lateral pressure entering the space between the spigot end of the pipe and the seat of the socket, the pressure being applied at right angles to the direction of flow. Therefore, water flowing through the pipe will have the same effect upon the joint so far as leakage is concerned regardless of the direction of flow as long as the pressure remains the same. The stability of joints in cast iron pipe is dependent upon three factors, pressure, water hammer and vibration. As the direction of flow or position of bell can have no effect on these conditions, they may be disregarded except as affecting the convenience of laying the pipe.

C. R. KNOWLES, superintendent of water service, Illinois Central.

SECOND ANSWER

In attempting to answer this question my first thought is to call attention to the present practice in pipe laying and manufacture, for the reason that in the case of so familiar an item of equipment, present practice is more than likely to be good practice and for the additional reason that whether right or wrong present practice must be reckoned with in so far as standards of manufacture govern usage. Thus we find that in the case of iron pipe Y's the branch has a bell end and a bell end is also standard for the upper leg of the base elbow (elbows provided with a cast base). Manifestly it is but natural that work should be laid out with these standards in mind.

As to what constitutes good practice these same standard forms of construction afford an indication. It would seem from the construction of the Y branch that the bell end of cast iron pipes was intended to be laid up stream, and, indeed, on comparatively level stretches this is so consistently the practice that the finding of pipes with the bell end laid down stream immediately gives rise to a question as to the competency of the responsible party. The basic principle underlying this practice, of course, is that involved when liquid is poured into the cup end rather than the spout of a funnel, a principle brought forcibly home to the writer in its application to bell and spigot pipe when witnessing an incident in which a contractor failed in his attempt to drain away certain surface water by means of sewer pipes, temporarily placed and grouted at the joints, until all the pipe was reversed in order to bring the bell end of each pipe up stream. The reason for the failure, of course, was that the flowing water washed out the grouting and forced the joints apart. In cast iron pipe well leaded the tendency of the water in flowing to do this is, of course, reduced to a minimum. In fact, such pipe oftentimes is able to carry water equally effectively in one direction as another, but as a general rule it is better to follow the general practice of laying the bell end up stream when other conditions do not arise to prevent this being done. In one instance known to the writer the frequent blowing out of joints in a pipe laid on a flat grade was to all appearances justifiably attributed largely to the fact that the bell end of the pipe was laid down stream.

An additional rule for the laying of this pipe is the one brought out in the construction of the base elbow mentioned above, that the bell end should also be up-hill. The advisability of this is a matter of common agreement where the pipe is extended vertically, it being much simpler, obviously, to lead a joint from above rather than from below. Where pipe is to be laid on a grade, however, particularly grades under 45 deg., this point is to be considered in relation to the relative importance of laying the bell up-stream and also with reference to the direction in which the work progresses.

As to the last-mentioned point good practice requires above all else that cast iron pipe should be laid with the bell end in advance of the work. The reason for this is obvious to one accustomed to laying much pipe. In the first place the method constitutes the simplest and quickest way of laying the pipe, each section of pipe being set to grade simply by adjusting the bell end, and the work of leading presenting no disturbance to the forward work or to back-filling. Also where the work is advancing up-

hill the most convenient means is thus provided of draining away any ground water in the trench by allowing it to enter the bell end of each pipe as it is laid. But even more important, this method insures a better joint being made for the reason that all impacts arising in the leading of the joints or placing of the pipe is directed against the pipes already laid, obviously a much more satisfactory and effective way of working than where the application of the lead is made in the opposite direction. Good practice thus requires that all pipes should be laid with the bell end in advance of the work and that the work should be arranged so that at the same time the bell end may be placed up-stream and up-hill, any confliction arising between the last two points being decided on in the light of the local conditions.

SUPERVISOR WATER SERVICE.

HOW TO INTERPRET TIMBER TESTS

A VAST FUND of information is available concerning the strength of timber in the form of tests made by the Forest Products Laboratory, state universities and a large number of private concerns, but, as pointed out by the Committee on Timber before the recent convention of the American Society for Testing Materials, such information must be interpreted with a great deal of care to avoid the drawing of wrong conclusions. It is necessary to know something of the selection of the material, the size, grade and condition of the test specimens and the purpose for which the various tests were made.

The committee offers the following comments in regard to working stresses in structural timbers:

1. It is well determined that the strength of a particular piece of timber is in a measure determined by the condition under which it is used. From the tests it is seen that increase in moisture decreases the strength of timber, therefore it must be determined, first, in designing a particular structure, what the moisture conditions are,

2. It is also well determined by the tests that resistance to suddenly applied loads is much greater than to slowly applied or constant loading ; therefore the condition of loading will effect the amount of allowable stress.

3. Warning of failure of a piece of timber in a structure is usually given a considerable time in advance of actual failure; therefore, when efficient inspection is had this feature gives an element of safety in older structures.

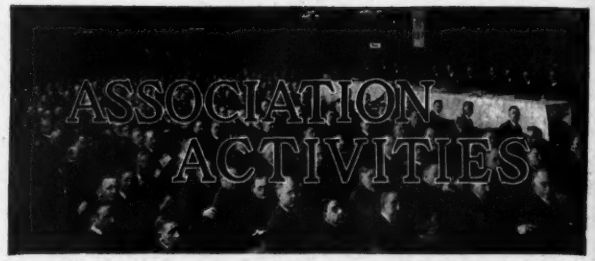
While there is no well-defined "elastic limit" in timber tests, there is in general a region where the proportionality of stress to strain ceases to be constant. It is therefore well to keep stresses well within this limit. Timber, however, does recover from high stresses; therefore its resistance to quick loading.

From the above it will be seen that in order to have a rational design it is necessary to state working stresses of different amounts for different kinds of loadings and exposure of the timber. As an example, for dense structural yellow pine, the minimum working stress will be 1100 lb. per sq. in. This is for constant loading and for submerged locations where the timber is constantly wet. In locations in the weather, such as bridges, the allowable working stress for constant loading is 1400 lb. per sq. in. Under cover, where the timber is always dry, the allowable working stress for constant loading is 1600 lb. per sq. in.

From the tests, it is determined that the resistance of timber is approximately proportional to the speed of loading. For constant loading, the stresses above given are proper, but for sudden loading, resulting in 100 per cent impact, the successive loadings being far enough apart so as to allow reasonable recovery of the timber, the allowable stresses may be doubled (not to exceed 2800 lb. per sq. in.), the stresses due to this sudden loading being those actually computed from the load with the impact. For other proportions of impact, less than 100 per cent, the allowable working stress may be increased in a ratio equal to the percentage of impact. For dense structural yellow pine, the allowable working stresses would, therefore, be as follows:

1. For wet or submerged locations...$1100 + 1100I$ lb. per sq. in.
2. For exposed locations (bridges)..$1400 + 1400I$ " "
3. For constantly dry locations.....$1600 + 1600I$ " "

where I is the proportional impact stress.



THE AMERICAN RAILWAY ENGINEERING ASSOCIATION

Owing to inability to make the necessary arrangements for accommodations at the Coliseum, the National Railway Appliances Association has changed the date for its annual exhibit of railway engineering and maintenance of way equipment from March 20 to 23, inclusive, to March 13 to 16, inclusive. The American Railway Engineering Association will also move its convention one week ahead, so that it will hold its meeting from March 14 to 16, inclusive.

THE BRIDGE AND BUILDING ASSOCIATION

Plans for the next convention which will be held in New York in October are assuming final form. It is expected that a special train will be secured from Chicago to New York for the accommodation of those members from Chicago and points west, stopping at a number of points of engineering interest en route. In addition to the regular program of the convention it is planned to make an inspection of the Pennsylvania and Grand Central terminals on the concluding afternoon of the convention.

ROADMASTERS' CLUB AT CHICAGO

A number of roadmasters and others interested in the maintenance of tracks gathered at the Engineers' Club, Chicago, on the evening of July 18 to perfect an organization for the discussion of problems incident to their work, similar to the track supervisors' clubs organized recently at Chicago and Buffalo. The first meeting of this organization will be held in Chicago on Wednesday evening, August 17, at which time a permanent organization will be effected and a program will be presented of live interest to trackmen.

THE ROADMASTERS' ASSOCIATION

The members of the Executive Committee and the Chairmen of the committees of the Roadmasters' Association met at the Hotel Statler, Cleveland, on Saturday, July 9, to consider the work of the Association and to pass upon the reports which will be presented before the annual convention at Chicago on September 20-22, inclusive. The tentative program for the convention was approved and the various committees were instructed to proceed with the completion of the final arrangements. T. M. Donahoe, general supervisor of road on the Baltimore & Ohio, was appointed treasurer to fill out the unexpired term of Coleman King, deceased.

The program prepared is as follows:

TUESDAY MORNING, SEPTEMBER 20.

10:00 a. m. Convention called to order.
Opening business, president's address, etc.

11:00 a. m. Committee report: "The Construction and Maintenance of Railroad Crossings," D. O'Hearn, roadmaster, Elgin, Joliet & Eastern, Joliet, Ill., chairman.

TUESDAY AFTERNOON

2:00 p. m. Paper: "Results Obtained from the Use of Treated Ties," J. H. Waterman, superintendent, timber preservation, Chicago, Burlington & Quincy, Galesburg, Ill.

3:00 p. m. Committee report: "The Most Economical Method of Handling and Renewing Cross and Switch Ties," E.

P. Hawkins, division engineer, Missouri Pacific, Wichita, Kan., chairman.

WEDNESDAY MORNING, SEPTEMBER 21.

9:30 a. m. Committee report: "Methods of Stimulating Rivalry Among Track Forces," Geo. T. Koontz, roadmaster, Delaware & Hudson, Carbondale, Pa., chairman.

11:00 a. m. Paper: "The Budget System as Applied to Track Work," C. A. Morse, chief engineer, Chicago, Rock Island & Pacific, Chicago.

WEDNESDAY AFTERNOON.

2:00 p. m. Committee report: "The Classification and Distribution of Second Hand Rail," L. E. Dale, supervisor Pennsylvania, Philadelphia, Pa., chairman.

3:00 p. m. Committee Report: "The Records and Accounts of a Roadmaster's Office," F. J. Meyer, assistant engineer, New York, Ontario & Western, Middletown, N. Y., chairman.

6:30 p. m. Annual dinner of Roadmasters and Maintenance of Way Association and Track Supply Association.

THURSDAY MORNING, SEPTEMBER 22.

9:30 a. m. Paper: "The String Lining of Curves—Methods and Results," H. L. Pierce, supervisor, Pennsylvania, Cresson, Pa.

10:15 a. m. Business session, including election of officers, etc.

12:30 a. m. Adjournment.

THURSDAY AFTERNOON

Arrangements are being made for a visit to some interesting operations of value to maintenance men.

THE AMERICAN WOOD PRESERVERS' ASSOCIATION

The association is establishing a service bureau with headquarters at 10 S. La Salle street, Chicago. P. R. Hicks, engineer in forest products of the U. S. Forest Products Laboratory, Madison, Wis., for the past 13 years, has been appointed secretary-manager. The bureau has been established to promote the use of treated timber and thereby conserve the forest resources of the country. It will be prepared to furnish information concerning the possibilities for the use of treated timber economically, and to answer inquiries and provide data regarding the durability of treated and untreated wood.

GUARANTY CERTIFICATES ISSUED

During the last month the United States Railroad Administration has reported the following final settlements, and has paid out to the several roads the following amounts: Galveston Wharf Company, $85,000; the Duluth Union Depot & Transfer Company, $21,000; St. Joseph Belt, $95,000; Chicago River & Indiana, $45,000; Chicago Junction, $380,000; Hudson & Manhattan, $750,000; West Side Belt, $1,080,000; Pittsburgh & West Virginia, $720,000.

The Interstate Commerce Commission has issued certificates for partial payments on account of the six months' guaranty for 1920 as follows:

Chicago, Peoria & St. Louis	$ 110,000
Denver & Rio Grande	937,500
Grand Canyon	9,500
Panhandle & Santa Fe	550,000
Rio Grande, El Paso & Santa Fe	40,000
Erie	1,000,000
Fernwood, Columbia & Gulf	18,000
Middletown & Unionville	35,000
New Orleans Great Northern	130,000
St. Johnsbury & Lake Champlain	70,000
Winston-Salem Southbound	10,000
Trinity Valley	1,500
Susquehanna & New York	50,000
Manistique & Lake Superior	33,000
Flint River & Northwestern	4,000
Chicago Great Western	150,000
Georgia & Florida	150,000
Chicago & Alton	200,000
Buffalo, Rochester & Pittsburgh	135,000
Chicago, St. Paul, Minneapolis & Omaha	115,000
Minneapolis Eastern	17,000
St. Joseph Belt	62,500
Trans-Mississippi Terminal	55,000

THE MATERIAL MARKET

ANOTHER official reduction in the prices of iron and steel products has occurred since the appearance of last month's market report. This time the initiative was taken by the Bethlehem Steel Company on July 4, followed by an announcement on July 6 by the United States Steel Corporation confirming the prices previously announced by the independent company. These reductions were moderate in practically all cases, representing compromises between the previously established quotations and the lower prices at which a number of the independent producers were selling their products. As a consequence sales are still being made at prices appreciably below those announced early in the month, but owing to the limited amount of business done but little information is available as a basis for these independent prices. As a consequence the tables below give only the established prices as of July 15, with the understanding that in many cases material is being sold at prices appreciably lower. It will be noted that appreciable concessions have been made with respect to track spikes, bolts and iron tie plates. Reductions in the case of angle bars and steel tie plates are anticipated, but have not been announced thus far. It will also be noted that a further reduction has been made in the case of cast iron pipe, while concessions of from $2 to $6 have been made in the list prices of wrought steel pipe.

	July 17				July 15	
	Pittsburgh		Chicago		Pittsburgh	Chicago
Track spikes	$3.25	$3.40	$3.58	$3.78	$3.00	$3.38
Track bolts	4.00	4.35	4.58	4.73	4.00	4.38
Angle bars				2.75		2.75
Tie plates, steel				2.50		2.50
Tie plates, iron				3.00		2.50
Plain wire	2.75	3.00	3.13	3.38	2.50	2.88
Wire nails	3.00	3.25	3.38	3.63	2.75	3.23
Barbed wire, gal.		3.85		4.23	3.40	3.78
C. I. pipe, 6 in. or larger per ton				54.10		49.10
Plates	1.90	2.20	2.28	2.58	2.00	2.38
Shapes	2.00	2.20	2.48	2.58	2.00	2.38
Bars	2.00	2.10	2.23	2.48	1.90	2.28

The scrap market is still on the decline and the prices at present are clearly lower than at any time since the inception of war business in this country. Of particular emphasis is the fact that the price of relaying rails is nearly $20 lower than that of new rail.

	Chicago	St. Louis
	Per Gross Ton	
Relaying rails	$27.50 to $30.00	$27.00 to $29.00
Rerolling rails	12.50 to 13.00	12.00 to 12.50
Rails less than 3 ft. long	11.50 to 12.00	11.50 to 12.00
Frogs and switches cut apart	10.00 to 10.50	11.00 to 11.50
	Per Net Ton	
No. 1 railroad wrought	9.25 to 9.75	9.00 to 9.50
Steel Angle bars	9.50 to 10.00	9.00 to 9.50

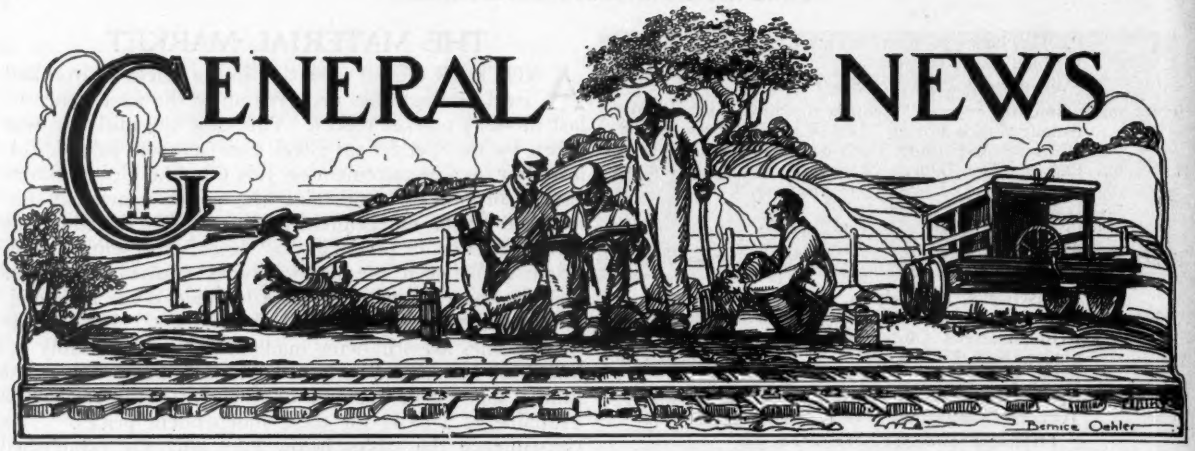
In the tables of lumber prices given below it will be noted that there has been little change from last month. Douglas fir prices remained stationary, and while the Southern pine prices have been subjected to fluctuations, the net result is about the same as the quotation appearing in last month's issue.

SOUTHERN PINE MILL PRICES

	June	July
Flooring, 1x4, B, and B flat	$32.33	$32.24
Boards, 1x8, 14 and 16, No. 1	23.84	26.20
Dimension, 2x4, 16 No. 1	22.61	21.78
Dimensions, 2x10, 16 No. 1	22.92	22.13
Timbers, 4x4 to 8x8, No. 1	20.44	21.02
Timbers, 3x12 to 12x12, No. 1	28.13	22.25

DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2 clear, flat	$22.00	$22.00
Boards, 1x6, 6 to 20, No. 1, common	12.00	12.00
Dimensions, 2x4, 16 No. 1, common	12.50	12.50
Dimensions, 2x10, 16 No. 1, common	12.50	12.50
Timbers, 6x6 to 8x8 No. 1, common	17.00	17.00
Timbers, 10 x10 to 12x12, rough	16.00	16.00



The Illinois Central established a new record for passenger train performance during the month of May, when a total of 13,567 trains were operated, 13,461, or 99.2 per cent of which maintained scheduled time.

The Detroit, Toledo & Ironton filed a freight schedule with the public utilities commission of Ohio on July 18, providing for a 20 per cent reduction in rates between all points on its line, but not affecting connecting line rates.

Mexico is considering the purchase of several millions of dollars worth of second-hand American railroad construction material for use upon extensions now being built to its national system, according to information received from the City of Mexico.

Missouri, Kansas & Texas locomotive No. 392, a coal burning Pacific type of 41,000 lb. tractive effort, recently made a continuous run of 1,024 miles at an average speed of 40 miles per hour in hauling a special train to the Shriners' convention at Des Moines. The engine was in good condition upon arrival at Kansas City.

During the investigation recently held by the Senate Committee on Interstate Commerce in Washington, D. C., it was shown that the wage bill of the railroads in 1920 was $3,698,000,000, a figure which exceeded the gross revenues of the railroads in 1916, the best year in railroad history prior to the war, by over $100,000,000.

The Tennessee & Cumberland River Railroad, a 14-mile line extending northward from its junction with the Louisville & Nashville, about 100 miles west of Bowling Green, Ky., which was built to develop the timber and mineral properties of the Cumberland River Land Company, has been abandoned and its tracks torn up.

That conventions are good business for the railroads is indicated by the fact that the convening of Elks at Los Angeles, Cal., on July 11, called for 14 special west-bound trains on the Santa Fe alone. Two thousand passengers were carried to the convention from different parts of the country on special trains, three of which originated at Philadelphia.

Another instance pointing to the danger of leaving loose rubbish accumulated near railroad properties is furnished in a fire which occurred in the yards of the Chicago Junction at Chicago on July 4 in which a yard office and 20 empty freight cars were destroyed and 40 additional cars damaged. The fire started in loose rubbish from an unknown cause and was spread when a barrel of oil near it exploded.

A booklet entitled "What Every Employee Should Know" has been published by the Illinois Central for the education of its employees. This booklet gives an account of the history of the Illinois Central from its beginning in 1851, when the construction of 14 miles of lines from Chicago to Calumet was begun, to the present time, when the organization comprises 8,000 miles of line and serves 15 states.

The demand for freight cars continues to increase, according to reports received by the Car Service Division of the American Railway Association. For the month of June there was an average of 385,723 surplus freight cars, or a decrease of 52,964 as compared with the preceding month. This increase was due in part to a considerable increase in the demand for cars for the shipping of grain and merchandise and has the general effect of reducing still farther the surplus of cars, which reached the high point of over 507,000 in April.

A report has recently been made by the New York Transit Commission on passenger traffic in and out of New York City which shows 36,937,129 passengers at the Grand Central Terminal in 1921. The Pennsylvania Station was second, with a total of 35,947,570, while the Long Island Station at Flatbush avenue, Brooklyn, was third, with 33,968,090. The report shows that in 1920 the steam roads together handled 252,763,523 passengers, which was an increase of 7 per cent over the number handled in 1919.

A sixty-day accident prevention campaign was recently conducted on the Baltimore & Ohio among employees at the principal terminals and shops, with the result that a reduction of 81 per cent in the number of casualties per thousand man-hours of work was effected. During the campaign a record was kept of all bodily injuries and after each accident an investigation was held to determine what could be done to prevent its recurrence as well as to determine its nature. On the whole system an increase of 231 per cent was effected in man-hours of work per casualty.

A new bridge has been proposed for construction in the city of New York which, if built, will be one of the world's largest structures. The proposed bridge is of the suspension type. It is a double-deck structure, 235 ft. wide, with a river span of 3,240 ft. and approach span of 1,710 ft. The upper deck includes a central roadway 155 ft. wide and two 15-ft. promenade walks, while the lower deck is designed for six double-track railway tubes. The present estimated cost of the bridge is $100,000,000. It is proposed to extend the structure across the Hudson River from 59th street in Manhattan to Weehawken, N. J.

All engineering field work connected with valuation in the Eastern District of the Division of Valuation of the Interstate Commerce Commission has been completed and the engineering force has been assigned to the preparation of the reports showing the costs of reproduction of the properties included in this district. This district includes the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, West Virginia, Virginia, and North Carolina. The field work was begun on February 26, 1914. This is the last of the five districts to complete its field work.

A serious coal shortage is likely to occur this winter unless a greater proportion of the annual requirements for coal are purchased in the next few months than is being purchased at the present time. It is estimated that the requirements for coal this year should be from 70,000,000 to 140,000,000 tons more than in 1914. Nevertheless, in the first six months in 1921 the amount of coal produced and shipped was 9,000,000 tons less than in the same months of 1914, and in fact less than in the first six months of any of the last eight years except 1915. At the present rate of output the total production of 1921 will be less than 400,000,000 tons, a figure smaller than that for any year since 1909.

PERSONAL MENTION

GENERAL

W. D. Pearce, supervisor of bridges and buildings on the Northern Pacific, with headquarters at Glendive, Mont., has been appointed trainmaster at Forsyth, succeeding Mr. Taylor.

Charles F. Staples has been selected to serve as acting director of valuation of the Interstate Commerce Commission until a permanent appointment is made to fill the vacancy resulting from the death of Charles Azro Prouty. Mr. Staples has been associate director of valuation for several years.

ENGINEERING

J. N. Olson, assistant engineer on the Gulf lines of the Atchison, Topeka & Santa Fe, with headquarters at Galveston, Tex., has been transferred to the office of the chief engineer, with headquarters at Chicago.

William C. E. Becker, structural engineer on the Missouri Pacific and formerly professor of civil engineering at Washington University, has resigned to become chief engineer of the Department of Public Safety of St. Louis.

John Schofield, formerly architect, Eastern Lines, Canadian National Railways, with headquarters at Toronto, Ontario, and **George B. Briggs,** architect, Western Lines, Canadian National Railways, with headquarters at Winnipeg, Man., have exchanged positions.

R. L. Huntley, chief engineer of the Union Pacific, has had his jurisdiction extended over the Los Angeles & Salt Lake, with headquarters at Omaha, Neb., succeeding Arthur Maguire, who has been appointed assistant chief engineer, with headquarters at Los Angeles.

C. M. Staples, assistant to the corporate engineer of the Southern Pacific, with headquarters at San Francisco, Cal., has been appointed division engineer of the Houston division, with headquarters at San Antonio, Tex., succeeding R. W. Meek, who has been assigned to other duties, effective July 15.

H. M. Righter has been appointed division engineer on the Erie, with headquarters at Susquehanna, Pa., succeeding **Charles M. Lewis,** transferred to Jersey City, N. J., to take over a part of the territory formerly under the jurisdiction of **S. J. Malloy,** division engineer, with headquarters at Jersey City. In connection with the changes resulting from the recent consolidation of regional offices, the headquarters of **J. C. Patterson,** regional engineer, have been changed from New York City to Jersey City.

Alan H. Jones, who has been appointed assistant engineer of standards on the Canadian National Railways, with headquarters at Toronto, Ont., was born at Liverpool, England, in 1884. Entering railway service in 1911 as an assistant on the Windsor street station reconstruction, Mr. Jones served successively as instrumentman on construction on the Canadian Pacific, with headquarters at Campbellford, and as draftsman, resident engineer and assistant engineer on the Canadian Government Railways prior to his recent appointment.

TRACK

M. J. Rohne, roadmaster on the Expanse subdivision of the Moose Jaw division of the Canadian Pacific, with headquarters at Assiniboia, Sask., has been transferred to the Kerrobert subdivision, with headquarters at Kerrobert, Sask., in place of L. Herbert, transferred.

P. Lorentzen, roadmaster of the Merced district, Stockton division, of the Southern Pacific, Pacific System, with headquarters at Merced, Cal., has been transferred to the Tracy district, with headquarters at Tracy, Cal., succeeding F. A. Green, who has been transferred to the Merced district, with headquarters at Merced, succeeding Mr. Lorentzen.

T. M. Pittman, Jr., whose promotion to roadmaster on the Louisiana division of the Illinois Central, with headquarters at Water Valley, Miss., was announced in the July issue, was born at Henderson, N. C., in 1887, and received his education at the Universities of North Carolina and Illinois, graduating from the latter in 1911 and receiving the degree of C. E. in 1916. Entering the service of the Illinois Central in 1905, Mr. Pittman was employed successively as engineer apprentice, rodman and instrumentman until the commencement of his university studies in 1908, after the completion of which he re-entered the service of the Illinois Central as rodman, from which he was promoted to instrumentman in 1912, thereafter to assistant engineer in 1915 and finally to assistant engineer on the Louisiana division in 1919.

BRIDGES AND BUILDINGS

Wm. Mulcahy, formerly assistant supervisor of bridges and buildings on the Chicago Northwestern, with headquarters at Adams, Wis., has been appointed supervisor, with headquarters at Baraboo, Wis., to succeed **M. Riney,** retired.

OBITUARY

J. C. Porter, assistant engineer on the Illinois Central Railroad, died June 6 at the Illinois Central Hospital, Chicago.

Charles Azro Prouty, director of valuation of the Interstate Commerce Commission, and for over 17 years a member of the Commission and its chairman in 1912, died at his home at Newport, Vt., on July 8, after having been ill for nearly a year. Mr. Prouty was born in October, 1853, at Newport, Vt. Graduating from Dartmouth College in 1875, he pursued the teaching profession and the practice of law until his appointment to the Interstate Commerce Commission in 1896, of which he remained a member until 1914, when he resigned to organize the valuation work.

John Findley Wallace, consulting engineer and charman of the Chicago Terminal Commission and one of the most prominent engineers in the United States, died suddenly on July 3 in Washington, D. C., where he was presenting testimony before the Senate committee investigating the railroad situation. Mr. Wallace was born at Fall River, Mass., on December 10, 1852, and was educated at Monmouth, Ill., in a college founded by his father. With the exception of his connection with the Panama Canal, of which he was the first chief engineer, Mr. Wallace's career was predominantly one in railroad engineering. His first railroad work of consequence dates back to 1879, when he entered actively in railway work as chief engineer of a line which later was consolidated with the Iowa Central. From then on Mr. Wallace was engaged almost continuously on various railroads, chief among which was the Atchison, Topeka & Santa Fe, of which he was bridge engineer (1887-1889), and the Illinois Central, of which he was successively engineer of construction, chief engineer, assistant second vice-president, assistant general manager and general manager until 1904, when he was appointed chief engineer of the Panama Canal Commission. Resigning from this position in 1905, he again became associated with railroad work, chiefly in the capacity of president and chairman of the board of directors of Westinghouse, Church, Kerr & Co., and as chairman of the Chicago Railway Terminal Commission.

John Findley Wallace

Mr. Wallace was the first president of the American Railway Engineering Association.

CONSTRUCTION NEWS

The Alabama, Florida & Gulf has been authorized by the Interstate Commerce Commission to construct four miles of line between Dothan and Wilson, Ala., and nine miles of line between Greenwood and Marianna, Fla.

The Atchison, Topeka & Santa Fe has authorized and will shortly accept bids for the construction of a viaduct over Merlin street, Dallas, Tex., to cost approximately $107,000. It will shortly accept bids for the construction of a new passenger and freight station at Longview, Tex., to cost about $28,000; and contemplates the construction of a new passenger station, hotel, and Harvey house at Newton, Kan. This company, noted in the July issue as contemplating the construction of an addition to its power house at Alburquerque, N. M., to cost about $150,000, has authorized this work and will shortly accept bids. This company, which was noted in the July issue as about to accept bids for the installation of a new 120 ft. turntable at Winslow, Ariz., is carrying out this project with company forces.

The Chicago, Burlington & Quincy is planning an addition to its yards at Centralia, Ill., and has resumed work, with company forces, on the street subway structures in connection with the track elevation project at Aurora, Ill. This company also has awarded a contract to G. A. Johnson & Co., Chicago, for the construction of an addition to its railway mail terminal at Omaha, Neb., and is accepting bids for the construction of a new grain elevator at St. Joseph, Mo.

The Chicago, Burlington & Quincy has awarded a contract to B. J. Martin, Billings, Mont., for the construction of an addition to the power plant at Sheridan, Wyo.

The Chicago Great Western has awarded a contract to Charles Weitz, Des Moines, Iowa, for the construction of a frame freight station with dimensions of 40 ft. by 480 ft., at Des Moines, to cost about $40,000.

The Chicago, Indianapolis & Louisville closed bids on July 16, for the construction of a new freight station at French Lick, Ind. The structure, which will be of brick construction, 26 ft. by 52 ft., will cost about $10,000.

The Chicago & Northwestern contemplates the construction of a new icing plant at Clinton, Iowa, to cost about $50,000.

The Chicago, Rock Island & Pacific is accepting bids for the construction of a 50 ton frame coaling station at Pipestone, Minn., and a 100 ton frame coaling station at Livermore, Iowa. It will also build a freight house at Omaha, Nebr., and will erect a round house at Memphis, Tenn.

The Chicago Union Station has awarded the contract for grading the new station site between Madison and Adams streets to W. J. Newman & Company, Chicago, and will shortly accept bids for wrecking the old Chicago & Alton freight house south of Van Buren street, Chicago. This company has also let a contract to the Brennan Construction Company, Chicago, for the construction of a 12-duct conduit line betwen Harrison and Van Buren streets, and a contract to the W. J. Newman Company for a temporary office building to be used in connection with the wrecking of the old Chicago & Alton freight house at Van Buren street.

The Chicago Union Station will shortly accept bids for the construction of the substructure of the Madison street viaduct, Chicago. The company will also shortly accept bids for widening the second link of Canal street, between Jackson and Van Buren streets.

The Duluth & Northern Minnesota has been authorized by the Interstate Commerce Commission to abandon its line extending from Knife River to Cascade, Minn., 99.25 miles.

The Great Northern has applied to the Interstate Commerce Commission for authority to abandon a branch line in Stevens County, Wash., 7.49 miles.

The Illinois Central is accepting bids for the construction of a one story brick express building at Mattoon, Ill., also for the construction of a frame engine house with dimensions of 60 ft. by 200 ft., at Herrin, Ill. The new facilities at Herrin will include concrete cinder pits, a sanding plant and water and sewer improvements. The company is also accepting bids for the construction of a new frame passenger and freight station at Duck Hill, Miss.; for the construction of two water-treating plants, one at La Salle, Ill., and the other at Assumption, Ill.; and for the new pumping station at Amboy. Ill., it having been decided to have the latter work done by contract instead of by company forces as originally intended. The company has awarded a contract to the Railway Water & Coal Company, Chicago, for water piping and sewer work in connection with the construction of additions and improvements to its roundhouse at Dubuque, Iowa, and is accepting bids for the construction of the substructure of a bridge south of Johnston, Miss., to cost about $30,000. This company, which, noted in the July issue as contemplating the construction of a pumping station at Ramsey, Ill., has closed bids for this work.

The Illinois Central has awarded the contract for a new brick passenger station at Speedway, Ill., with dimensions of 22 ft. by 60 ft., to Ellington-Miller, Chicago, and has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of a switchman's office and general yard office at Clinton, Ill., to cost about $25,000.

The Interstate Railway contemplates the construction of 14 deck plate girder bridges, near Norton, Va.

The International & Great Northern is accepting bids for the construction of a new hospital building at Palestine, Tex., to cost about $100,000.

The Louisville & Nashville has awarded a contract to Rommel Brothers, Louisville, Ky., for the construction of a brick and steel power plant at Paris, Tenn.

The Louisiana Railway & Navigation Company contemplates the construction of a new passenger station at Girod and Rampart streets, New Orleans, La., on a site purchased by the road some time ago.

The Maine Central is accepting bids for an 8 pit roundhouse and a 50 ft. by 220 ft. repair shop to replace fire losses.

The Mississippi Warrior Barge Line has commenced construction of a new floating freight terminal at Cario, Ill., to provide for the direct transfer of freight in the Illinois Central and the Mississippi Warrior Line.

The Missouri, Kansas & Texas contemplates the enlargement of its terminal at Denison, Tex., including the construction of a new roundhousse. The company also plans to enlarge its yard, roundhouse and freight house at Fort Worth; improve its roundhouse facilities at Waco; add to its yards and roundhouse at Smithville; install additional roundhouse facilities at Houston, and enlarge its freight house at Wichita Falls.

The Missouri Pacific is accepting bids for the construction of an employees' hospital at Grand and Shaw avenues, St. Louis Mo. The building will be a 7 story structure with a 2 story annex, and will be of concrete, brick and stone construction. The estimated cost is $450,000.

The Missouri Pacific has awarded a contract to Joseph E. Nelson & Sons, Chicago, for improvements to the terminal facilties at Hoisington, Kan., including the installation of a new 100 ft. turntable and the extension of the yards.

The Norfolk & Southern has applied to the Interstate Commerce Commission for authority to abandon the Carthage & Pinehurst, 12.2 miles.

The Oklahoma & Arkansas has applied to the Interstate Commerce Commission for certificate authorizing the con-

struction of 20 miles of line from Salina, Okla., to Kansas, Okla.

The Oklahoma & Arkansas has applied to the Interstate Commerce Commission for authority to issue $307,500 of stock for the construction of 20 miles of line from Salina to Kansas, Okla., and for the purchase of a locomotive.

The Pennsylvania has awarded a contract for the dismantling of its train shed at Jersey City, N. J., to Henry A. Hitner's Sons Company, Philadelphia, Pa. It is intended to replace this old structure with three low shelter sheds to take care of the passenger business which has been of a local character since the construction of the Pennsylvania terminal in New York City.

The Pittsburgh & West Virginia has let a contract to the John F. Casey Company, Pittsburgh, Pa., for the grading of 3½ miles of track into coal fields owned by John A. Bell, of Pittsburgh. The work includes one 70-ft. steel bridge.

The Southern Pacific has awarded a contract for the construction of a 1,420 ft. tunnel, about 7 miles from Portland, Ore., to the Hauser Construction Company, Portland.

The State of New York found all bids which were submitted for the construction of the barge canal terminal building at Rochester, N. Y., to be under the engineer's estimate of $233,310, and three of the six bids for the construction of a bridge across the Hudson River from Troy, N. Y., to Cohoes lower than the estimate of $572,180. No contracts have been awarded as yet.

The St. Louis-San Francisco contemplates the construction of a new freight and passenger station at Fayetteville, Ark., to cost about $70,000.

The Susquehanna & Western has applied to the Interstate Commerce Commission for authority to construct a branch from Bloomfield to Blain, Pa.

The Texas & Pacific is accepting bids for the construction of a new brick and tile passenger station at Ranger, Tex., to cost about $75,000.

The Toledo, Peoria & Western has awarded a contract to the Ogle Construction Company, Chicago, for the construction of a 100-ton frame coaling station at Cuba, Ill.

The Virginian has awarded a contract to the M. A. Long Co., Baltimore, for improvements in its shop facilities at Elmore, W. Va., consisting of a 5 stall addition to the roundhouse, an addition to the boiler house, and a new store house, tool house and oil house.

The Wabash has purchased 65 acres of land west of Oakwood, at Detroit, Mich., as a site for railroad yards and general development of its property. The strip is approximately 500 feet wide and a mile long, and is just north of the land bought in 1916 by the Pennsylvania-Detroit.

EQUIPMENT AND SUPPLIES

The Akron, Canton & Youngstown is inquiring for 600 tons of 80 lb. rails.

The Boston & Maine has a contract under consideration for 250 tons of structural bridge material.

The Chesapeake & Ohio has ordered 1,700 tons of bridge material from the Mount Vernon Bridge Company.

The Chicago, Burlington & Quincy is inquiring for 200 tons of universal plates and angles.

The Chicago & Northwestern has ordered 1,225 tons of steel from the Morava Construction Company, for use in the reconstruction of its elevator at Chicago, recently damaged by an explosion.

The Chicago, Burlington & Quincy will receive bids until August 5 for machinery for the electrical operation, including the end lift reduction gearing, for the Burlington (Iowa) drawbridge. This company will also receive bids August 5 for 400,000 standard double punched steel tie plates, and will receive bids up until July 29 for 800 spools of galvanized barbed wire fencing, 350 kegs of 7D, 100 kegs 8D, 49 kegs 16D, and 85 kegs 20D cement-coated heavy barbed car nails.

The Cincinnati Northern is inquiring for 20,000 tie plates for 80 lb. A. S. C. E. rail.

The Cleveland, Cincinnati, Chicago & St. Louis is inquiring for 155,000 tie plates.

The Great Northern is inquiring for 100 tons of wire products, fencing, etc.

The Kanawha & Michigan is asking for bids on 700 to 800 tons of structural steel for bridge work.

The Lehigh Valley has ordered 2,700 tons of steel for a transfer table at its Claremont, Jersey City, N. J., terminal.

The Mississippi Central is in the market for two 100 ft. second-hand steel bridge spans, designed for Cooper E-40 loading.

The Mobile & Ohio is inquiring for 550 kegs of spikes.

The New York Central will receive bids until August 1 for its present requirements of track bolts, track spikes, angle bars, tie plates, frogs, switch points and switches, switch plates, crossing frogs, terminal stud track bonds, guard rails, knuckle rails and movable points for crossings. This company will receive bids until August 3 for its shop requirements until September, on standard wire nails, galvanized and polished fence staples, steel plates, galvanized tie dating nails, bridge warning poles and woven wire fence. This company also will receive bids until August 2 for a minimum of 600,000 gal. and maximum of 800,000 gal. of asphaltum base fuel oil with gravity of 18-20 deg. Baume, cold test 10 deg.

The Norfolk & Western will receive bids on July 27, at Roanoke, Va., for 116,711 lbs. of steel plates, and for 75,000 lbs. steel bars.

The Peoria & Eastern is inquiring for 7,000 wrought iron tie plates.

The Southern Pacific is in the market for 4,800 kegs of spikes and 3,300 kegs of track bolts.

The U. S. Government River Terminal at St. Louis, Mo., has let a contract for 150 tons of structural material to the St. Louis Structural Steel Company.

The Wheeling & Lake Erie is inquiring for 200 kegs of spikes.

The Bolivian government has awarded a contract to the Ulen Contracting Corporation of New York and Chicago for the construction of a railway from Atocha, Bolivia, to Villazon, on the Argentine frontier. This line, to comprise 128 miles of meter-gage, will connect the Bolivian system with that of Argentina, an accomplishment which will considerably shorten the time necessary to make a trip from this country to Buenos Aires. Surveys are now being made and work will begin by January 1. The country through which the road will pass presents many difficult problems and five years are allowed for the completion of the line.

Among the figures presented by the railroads to the Senate Committee on Interstate Commerce to explain why the increases in railway earnings resulting from increased traffic and from increases in rates were more than absorbed by inceases in operating expenses are the following: In 1918, after the government took over the railroads, it was shown that revenues increased $866,000,000 over those in 1917 as a result of the increases made in freight rates, while the operating expenses increased $1,153,000,000 as a result of an $877,000,000 increase in the payroll. From 1918 to 1919 the revenues increased $264,000,000, while the expenses increased $417,000,000, owing to a $230,000,000 further increase in wages. In 1920 a further increase in revenues of $1,027,000,000 was effected principally as a result of an increased traffic, while the expenses increased $1,369,000,000, owing to a $855,000,000 further increase in wages over that of 1919. Taking the years from 1916 to 1920, it was shown that where revenues increased $2,575,000,000, operating expenses increased $3,411,000,000, due chiefly to an increase in the payroll of $2,230,000, which consumed 62.3 per cent of the revenues as compared with 40.83 in 1916.

SUPPLY TRADE NEWS

GENERAL

The Walworth Manufacturing Company has removed its general offices from its factory at First and O streets, Boston, to Pearl and High streets.

The Jeffrey Manufacturing Company, Columbus, Ohio, has moved its New York City office from 50 Dey street to 30 Church street, with **Harold B. Wood** as district manager.

The Dominion Oxygen Company, Ltd., has begun work on a new oxygen plant at Montreal, Que., to cost $250,000. The building will be 100 ft. by 100 ft., and will be a duplicate of the company's Toronto plant.

The Canadian Chicago Bridge & Iron Company, Limited, of Vicksburg, Ont., and Montreal, Que., has changed its corporate name to Horton Steel Works, Limited, the new name being selected in honor of the late Horace E. Horton, who founded the Chicago Bridge & Iron Works in 1865.

The Pittsburgh-Des Moines Company has made several changes in its personnel following the retirement of its president, **E. W. Crellin. W. H. Jackson,** formerly secretary and treasurer, has been elected president; **O. E. Guibert,** vice-president; **Geo. A. Smith,** secretary and treasurer, and **W. W. Hendrix,** vice-president.

The Dressel Manufacturing Corporation, New York, which is a reorganization of the Dressel Railway Lamp Works, has plans nearing completion for building a new and larger plant at Buffalo, N. Y. **William Smith,** formerly vice-president and general manager of the Montana Southern, is president of the new corporation; **F. W. Dressel,** vice-president, and **F. H. Gregory,** secretary and treasurer.

The Du Pont Company, Wilmington, Del., has developed and perfected a formula for the manufacture of straight dynamite which results in that explosive being proof against freezing, even in zero temperatures. The new explosive has been fully tested and proved and the formula for making it has been made standard in all the plants of the company producing dynamite. As a consequence of this development the company has determined to discontinue the manufacture of its former straight dynamite and hereafter all of this kind of explosive will be made by the new low-freezing method.

The Badger Concrete Mixer Company, Milwaukee, Wis., has purchased a 27½ acre tract of land at Winthrop Harbor, Ill., north of Chicago, where it will erect a factory unit, 80 ft. by 260 ft. One-half of the tract is to be used for the erection of dwellings for its workmen and officers. In addition to its own line the company will manufacture at this plant the McVicker tie plate for the Railway Safety Tie Co.

The Sullivan Machinery Company has moved its Cleveland office from 800 Park Building to Room 824 Kirby Building and has established a supply depot and service station for coal mining machinery and supplies at Seventh Avenue and Thirteenth Street, Terre Haute, Ind. **Ralph Stone** is manager at Cleveland, while **H. T. Wiley,** formerly of the engineering department at Claremont, N. H., is in charge of the new depot.

PERSONAL

Charles Copeland, assistant treasurer of the E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has been elected secretary, to succeed Alexis I. Du Pont, deceased.

N. C. Catabish general sales manager of the National Carbon Company, Inc., Cleveland, Ohio, has been assigned to other duties, and J. R. Crawford, general sales manager of the Union Carbide Sales Company, has been appointed to succeed Mr. Catabish.

P. L. Laughlin, assistant district sales manager of the Verona Tool Works at Chicago, has been promoted to district sales manager, succeeding John B. Seymour, whose appointment as sales manager of the Superior Supply Company, Chicago, was announced in the July issue.

De Forest Lillis, who has been appointed western representative of the Dressel Manufacturing Corporation, New York, successor to the Dressel Railway Lamp Works, has opened an office in the Railway Exchange building, Chicago. Mr. Lillis has had several years' experience as salesman of railway supplies, and has acted as eastern representative of various western railway supply manufacturers in New York. Before entering the supply field, he was in railroad service on the New York Central, his last assignment being that of chief clerk to the general superintendent of motive power.

Alfred L. Kuehn, vice-president in charge of operation of the American Creosoting Company of Louisville, Ky., has been elected president of the company, succeeding the late Alvin T. Hert, effective June 21. Mr. Kuhn was born at Chicago on August 16, 1877, and was educated at the University of Illinois, from which institution he graduated in 1900. In 1892 he entered railway service as a clerk and operator on the Illinois Central and was later a clerk in the machinery department. On June 1, 1898, he was appointed assistant engineer on the Wheeling & Lake Erie, a position he held until December, 1898. From June 1 to October 1, 1899, he was assistant engineer on the Chicago Drainage Canal. During the next year he was appointed assistant engineer on the Chicago & Alton and thereafter served as assistant engineer on the Cincinnati, Richmond & Muncie, and in 1902 was appointed engineer maintenance of way on the Chicago, Cincinnati & Louisville. Two years later he was appointed engineer maintenance of way of the Michigan division of the Cleveland, Cincinnati, Chicago & St. Louis, and in 1905 was transferred to the Chicago division of this road, with headquarters at Indianapolis, Ind. Four years later Mr. Kuehn was appointed general superintendent of the American Creosoting Company, which position he held until 1918, when he was promoted to vice-president in charge of operation, the position he held at the time of his recent appointment.

Alvin T. Hert, president of the American Creosoting Company of Louisville, Ky., and chairman of the board of directors of the American Tar Products Company, who died on June 7, was a prominent figure in the development of commercial timber preservation. He was born at Owensburg, Ind., on April 8, 1865. He started his business career in his father's store at Owensburg and thereafter was engaged in the general merchandising business until 1894, when he was appointed general superintendent of the Indiana reformatory, a position he held until 1903. In 1904 he was a principal in the organization of the American Creosoting Company, which at that time started its first plant at Shirley, Ind. Shortly thereafter Mr. Hert was elected president of the company, which today, with its affiliated companies, operates 17 plants in various parts of the country. From 1916 to 1920, inclusive, he was a member of the Republican national committee and of the executive committee of this body from Kentucky, and in 1916 he was western manager of the Republican presidential campaign. Mr. Hert made his home at Hurstbourne Farms, Jefferson County, Ky.

Alvin T. Hert

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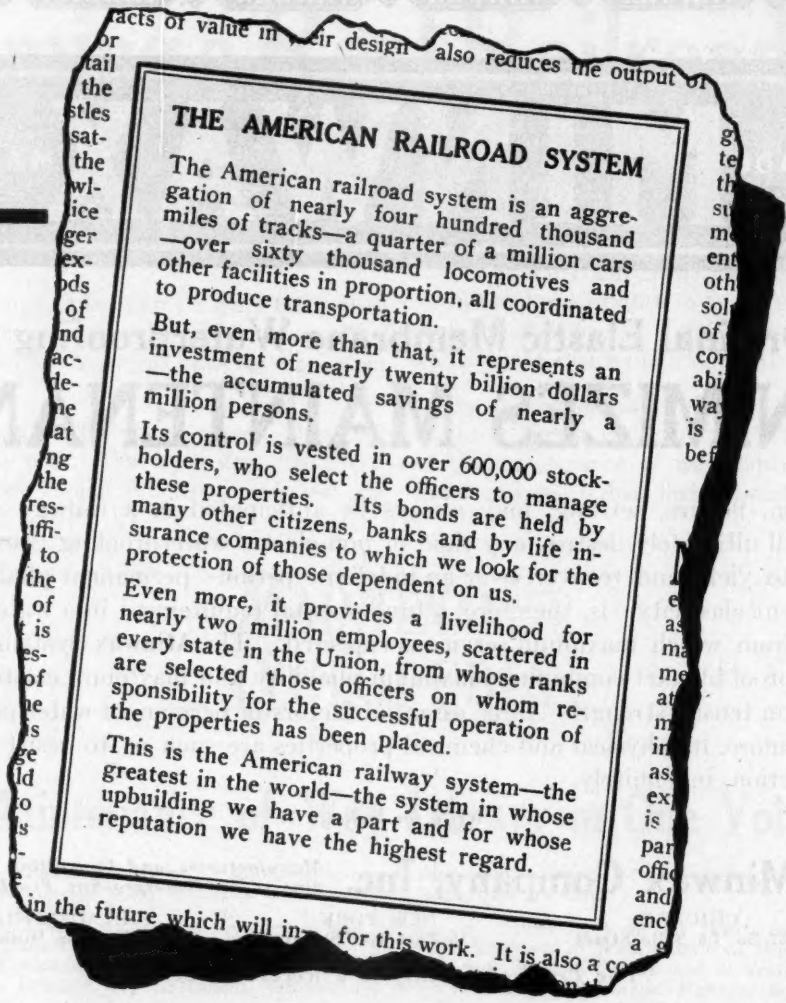

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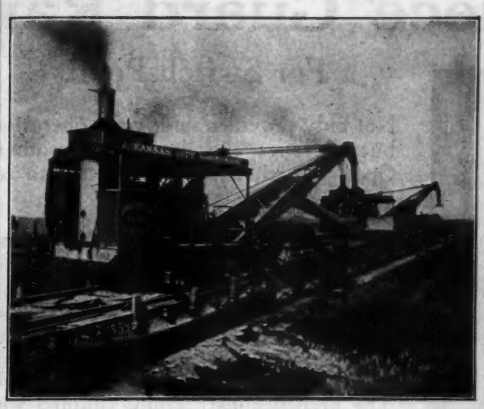

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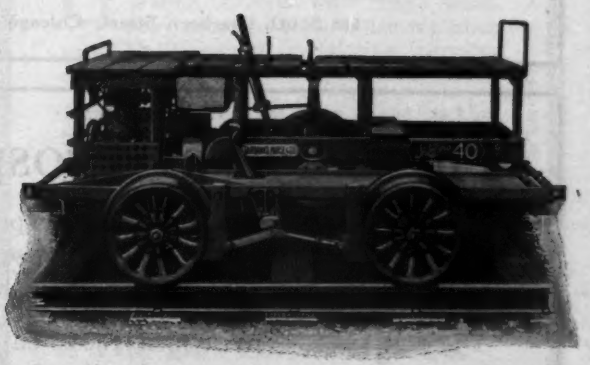

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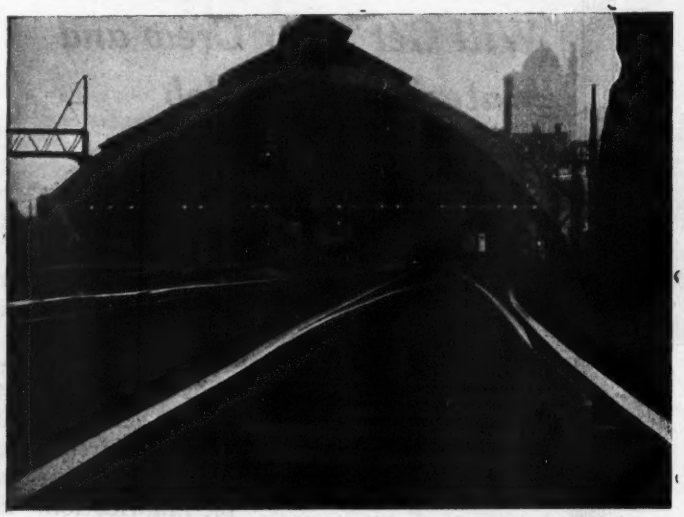

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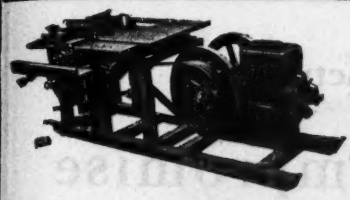
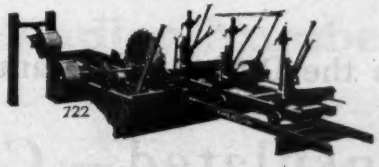

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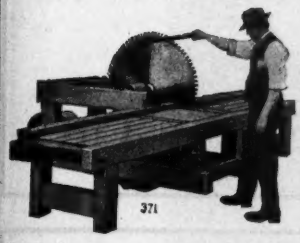

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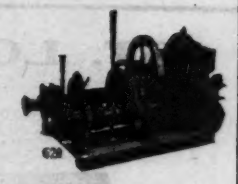

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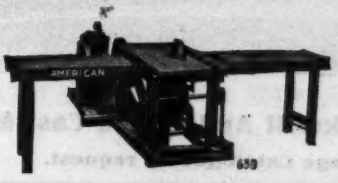

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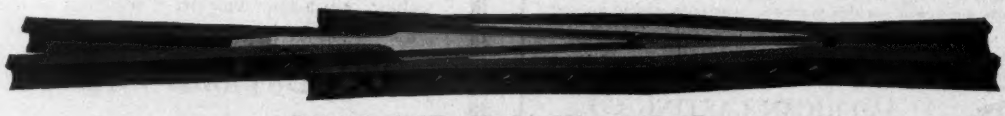

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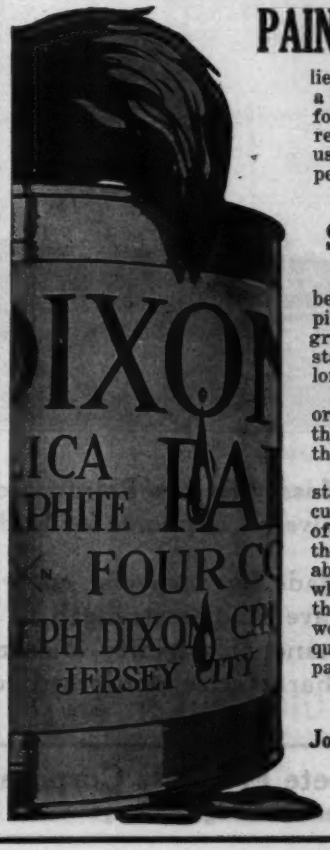


PAINT ECONOMY

lies in the application of a paint that will last for many years without repainting and not in using the "lowest price per gallon" paint.

DIXON'S Silica-Graphite PAINT

because of its unusual pigment, flake silica-graphite is able to withstand wear for the longest period.

It will not peel, crack or flake off because of the natural elasticity of this pigment.

As one user has stated, the saving secured through the use of Dixon's Paint made the paint and labor cost absolutely nothing when compared with the repaintings that would have been required had an inferior paint been used.

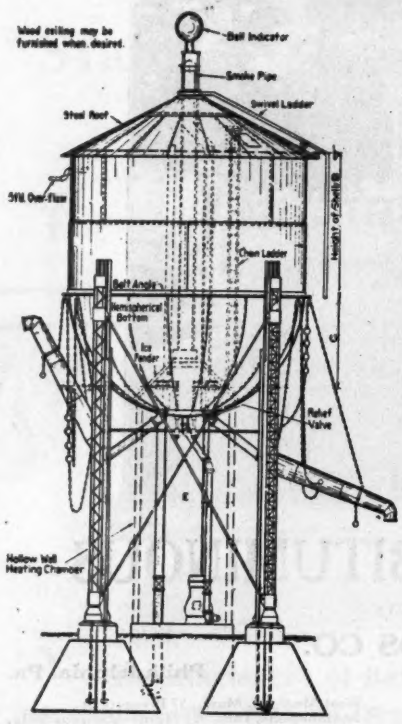
Write for long service records and Booklet No. 187-B

Joseph Dixon Crucible Company

Jersey City, N. J.
Established 1827

DES MOINES

For Railway Service



We specialize in the design, fabrication and erection of standard and special Railway Service Tanks, for mild or for cold climate, from 20,000 to 100,000 gallons capacity, elevated to any desired height.

The fabricated plates for standard designs are carried in stock, ready for immediate shipment. Special tanks can be designed and furnished promptly.

If you are interested in reducing maintenance costs to the absolute minimum, write for our special Railway Service Tanks booklet.

Pittsburgh-Des Moines Steel Co.

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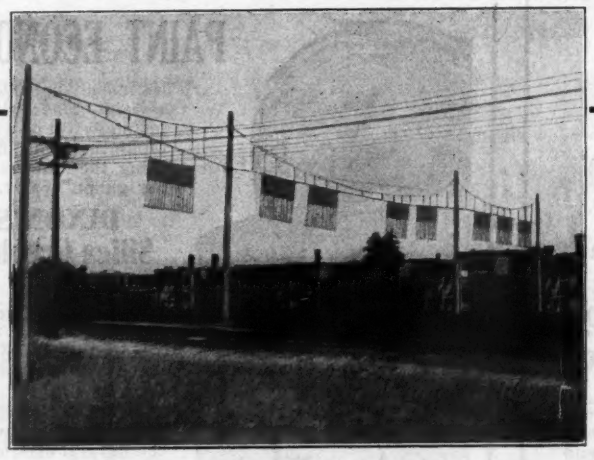
CHICAGO, 1242 1st Nat'l Bank Bldg.
DETROIT, 1142 Book Building
WASHINGTON, 942 Munsey Bldg.
SAN FRANCISCO, 342 Rialto Bldg.
DALLAS, 1242 Praetorian Bldg.

DES MOINES PLANT AND OFFICE:
942 Tuttle Street, Des Moines, Iowa

CANADIAN PLANT and OFFICES: Canadian Des Moines Steel Co., Ltd.
242 Inshes Ave., Chatham, Ont. 70 St. James St., Montreal, Que.



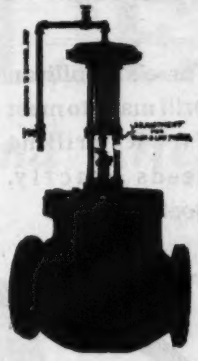
Concrete Poles for Bridge Warnings

Massey Hollow Reinforced Concrete Poles readily adapt themselves as supports for bridge warnings.

Made by a special centrifugal process—they are light and have all the strength of steel poles, combined with the permanence, rigidity and lack of maintenance expense which characterize reinforced concrete.

Massey Concrete Products Corporation
Peoples Gas Bldg., Chicago

New York 50 Church St. | Pittsburgh Oliver Bldg. | Atlanta Candler Bldg.
Dallas Sumpter Bldg. | St. Louis Ry. Exch. Bldg. | Salt Lake City 925 S. 6th St., W.



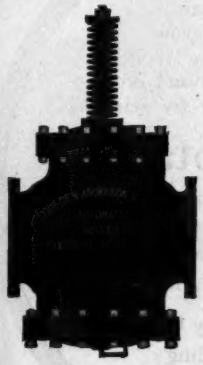
Keep a Uniform Stage of Water in Your Tanks

Stop wasting water and keep a constant head on your distribution system by equipping all reservoirs, stand pipes and tanks with

GOLDEN-ANDERSON PAT.

Automatic-Cushioned Controlling Altitude Valves

1.—Insure uninterrupted service and a positive water supply at all times.
2.—Prevent waste due to over-flow.
3.—Contain no floats or fixtures.
4.—Absolutely cushioned by both water and air in opening and closing. No banging, water hammer or burst mains.
5.—Can be opened and closed from distant points by simple electric solenoid attachment if desired.
6.—Can be made to work both ways to close automatically on a single pipe line in case of a break.
7.—Heavy construction throughout.



GOLDEN-ANDERSON
Pat. Automatic-Cushioned Water Pressure Reducing Valves

1.—Maintain a constant terminal water pressure under all conditions.
2.—Positively cushioned by water and air in opening and closing.
3.—Valve closes slowly, eliminating all shock and water hammer.
4.—Can be furnished with electric feature to open valve to full area from distant points.

GOLDEN-ANDERSON
Pat. Cushioned-Water Service Valve "FOR FIRE SERVICE"

1.—Can be opened and closed instantly from distant points by electricity.
2.—Current is on only a few seconds, thereby preventing waste.
3.—Can be fitted with either d.c. or a.c. solenoid.
4.—Perfectly cushioned by water and air. Positively no metal to metal seating.
5.—Can be closed by hand.

"HOSTS OF REFERENCES"

Golden-Anderson Valve Specialty Company

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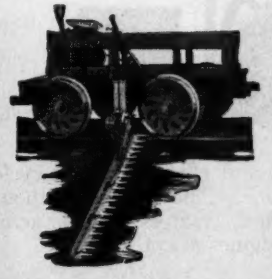
CUT DOWN EXPENSES— SAVE YOUR MEN'S TIME

for other work, by using

RAWLS TRACKMOWER



An attachment for Motor, Hand, or Push car, Operated by Section Men.

Cuts grass and weeds in one-twentieth of the time required by the old-fashioned scythe.

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(Watch this number grow)

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The original asphalt ready-to-lay roofing. Made from the same formula for over 28 years.

Smooth surfaced, fine talc dusted finish. Special large-headed sherardized (zinc impregnated) nails and Ru-ber-ine Cement in each roll.

Ru-ber-oid Roofing wears longer than ordinary prepared roofings, therefore, most economical.

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Green or red, slate surfaced, 8"x15¼", 5 inch exposure.

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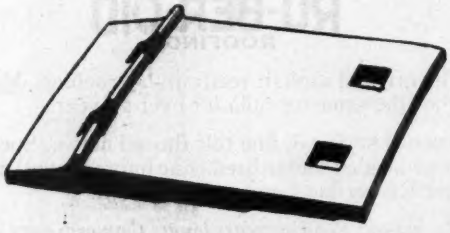


The Lundie Tie Plate

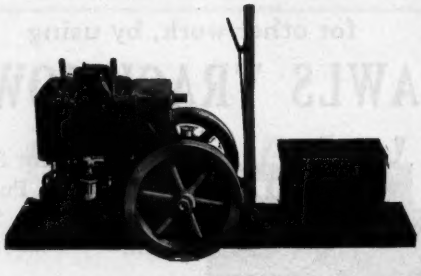
The Lundie Tie Plate is widely acknowledged by railroad men having such plates in track, as promoting decided economy in rail wear, in holding track to gauge and in giving easy riding track. It will far more than pay for itself in reduction of Operating Expenses.

The features of the plate are—a sloping seat inclining the rail, so reducing abrasion and internal stresses in the rail to a minimum—a true camber promoting easy riding—and a bottom, as shown in the cut, so seating itself on the tie that the track is held firmly to gauge without injury to the tie.

The combination of these features, or their mechanical equivalent, is covered by Letters Patent, supported by other Patents covering certain individual features of the plate. Railroad companies pay no royalties on its authorized use.

The Lundie Engineering Corporation
920 Broadway, NEW YORK
Chicago Office, 30 North La Salle Street

"Road Boss"



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Put your section car in this class by equipping it with a "ROAD BOSS" 4 cycle, 4 H. P. reversible engine. A substantial reduction effective May 1st; price includes complete equipment ready to mount. Can be furnished in either "ball" or "Liberty Motor" babbitt bearings.

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North American Engine Co.
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